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### THE PROBLEM OF ENDOMETRIOSIS\*

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I DEEPLY appreciate the honor of being invited to deliver this oration in memory of one of the great pioneers of abdominal and pelvic surgery.

Joseph Price was a disciple of that turbulent Scottish genius, Lawson Tait, and himself possessed so many of the qualities which distinguished that famous man that there is ample justification for describing him as Tait's American counterpart.

Both men were clinicians of outstanding ability who based their methods on accurate pathology, both were superb craftsmen whose achievements in the practical field of surgery were equaled by few and surpassed by none of their contemporaries.

I must add that both were keen fighters who thrived on controversy and who gave and expected no quarter in dealing with their adversaries.

*Autre temps, autre mœurs*; we now live in an age of compromise and heated discussions have almost become a thing of the past, but, although more pleasant, this method of settling our differences is not always the best and in Price's day, when great principles were at stake, might have seriously interfered with surgical progress.

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So let us be grateful to Joseph Price for his uncompromising advocacy of what he believed to be right as well as for his brilliant professional attainments, for both played a part in laying the foundations of modern pelvic surgery.

The problem of endometriosis is one of the most important in gynecology and well worthy of a place among the subjects dealt with by your Joseph Price Orators. Tonight, I propose to deal with the problem as a pathologic and clinical entity, and if I traverse well worn and familiar ground you will understand that this is unavoidable if the picture which I am going to paint is to be a complete one.

Endometriosis may be defined as the growth of endometrium in an abnormal situation, and it is said to be direct or internal when the endometrium lining the uterine cavity invades the subjacent muscle, indirect or external when the endometrial tissue reaches its destination by some other route.

The physiologic activity of the misplaced endometrium may produce an accumulation of the secretions poured out during menstruation or an irritative hypertrophy of the tissue invaded, the result in either case being a gross and frequently destructive lesion of the pelvic organs. In this way arise the adenomyomata, endometriomyomata, endometriomata and hematomata of different authors, but as a simple terminology is conducive to clear thinking and as the lesions are due solely to the activity of misplaced endometrium, I am of opinion that the terms internal and external endometriosis are sufficiently comprehensive for all purposes and that the others should be discarded as superfluous and needlessly confusing.

Further, as the term external endometriosis does not imply that the source of the misplaced endometrium is necessarily the uterine cavity, its use in the way suggested need not offend the susceptibilities of those who hold other views on etiology.

#### THE PATHOLOGIC PROBLEM

The evolution of our knowledge of endometriosis is one of the most fascinating chapters of gynecologic pathology and will be associated for all time with the names of two American workers, Thomas S. Cullen and John A. Sampson.

Uterine tumors containing both smooth muscle and glandular elements were recognized and described more than fifty years ago, but they aroused very little interest until the appearance of von Recklinghausen's important monograph on adenomyomata in 1896.<sup>1</sup> Up to that time the glandular elements were believed to be of Müllerian origin, but von Recklinghausen put forward the view that in the great majority of cases they were derived from the Wolffian body, although occasionally they might come direct from the uterine mucous membrane. The Wolffian



theory gained wide support but, even before its appearance, Cullen had entered the field and was laying emphasis on the mucosal origin of these tumors. In 1903<sup>2</sup> he reviewed the literature and reported 22 cases which he had examined up to that time and five years later<sup>3</sup> he published a comprehensive monograph on the subject and brought forward the most conclusive evidence that uterine adenomyomata were generally of mucosal origin.

Cullen's theory carried the day as far as the diffuse uterine tumors were concerned, and he himself was satisfied that it also offered an adequate explanation of the origin of subperitoneal and intraligamentary growths. In 1914<sup>4</sup> he went a step further and expressed the view that the glands in adenomyomata of the rectovaginal space undoubtedly arose from uterine mucosa or from remnants of the Müllerian duct.

There still remained a number of extrauterine tumors, notably those found in the round ligament, ovary, and umbilicus, whose origin was less easy to explain.

In 1898<sup>5</sup> Iwanoff described a case of adenomyoma complicated by carcinoma and sarcoma and concluded that certain cystic spaces in the tumor were of serosal origin.

This was an observation of the first magnitude and offered an explanation of the origin of these tumors which was capable of almost limitless application. The serosal theory found many adherents and Robert Meyer<sup>6</sup> gave it his blessing and elaborated from it his own theory of epithelial heterotopy or displacement. Meyer pointed out that this infiltrative activity of the epithelium was in no sense malignant but was part of a healing process associated with a pre-existing inflammation and not limited to any one part of the body. While the mucosal theory was adequate for the great majority of uterine tumors, he thought that heterotopy of serosal epithelium was the probable explanation of the existence of the epithelial spaces and cysts in most of the extrauterine swellings found between the rectum and the genital tract.

The stage was now set for the appearance of Sampson and even those who do not agree with all his conclusions must admit that his brilliant contributions from 1921 onwards have floodlit the controversial scene and enabled us to view the whole problem of endometriosis, both uterine and extrauterine, in proper perspective.

As long ago as 1899 Russell<sup>7</sup> described a case in which uterine mucosa was present in the ovary and which he thought originated from aberrant portions of the Müllerian duct.

About the same time Pick<sup>8</sup> found cysts of the ovary containing syrupy, chocolate-colored or reddish brown bloody contents and lined by a mucous membrane made up of elements similar to those found in the uterine mucosa, and he suggested the term *adenoma endometrioides ovarii* for such endometrial invasions of the ovary.

At a meeting of the Gynaecological Society of the Netherlands in May, 1904, Semmelink and Joselin de Jong<sup>9</sup> showed a specimen of extensive endometriosis of the pelvic organs in which both ovaries were cystic and one contained endometrial tissue in the hilum with a process extending into the stroma.

Finally, in 1920, Cullen<sup>10</sup> published a paper on the distribution of adenomyomata, containing uterine mucosa, and described three specimens of ovaries which he had obtained from different sources and in which endometrium was present.

While undoubtedly of great interest and importance, these specimens were looked upon as pathologic curiosities until the appearance of Sampson's classical paper on perforating hemorrhagic cysts of the ovary in the summer of 1921.<sup>11</sup> This author called attention to a type of hemorrhagic ovarian cyst or ovarian hematoma which was important not only because of its frequency but also because of the nature of the adhesions resulting from the escape of its contents into the peritoneal cavity. Sampson believed that the leakage was due to a perforation which later became sealed by adhesion to neighboring structures.

In 1910 his attention had been first directed to the dense peritoneal adhesions which may result from the escape of the cyst contents and in 1912 he had observed their association with adenomyomata of the posterior uterine wall and adhesions between the latter and the rectum, but in the paper quoted he was able to bring forward histologic evidence that tissue of endometrial type was invariably present in the ovary, particularly in the neighborhood of the perforation.

Sampson concluded that here was a primary growth of the ovary containing tissue resembling endometrium both anatomically and physiologically and by leakage of the cyst contents capable of extension to the neighboring structures in a manner similar to that found in the case of rupture of a papilliferous or malignant ovarian tumor.

In his 1921 paper Sampson offered no explanation of the frequency with which endometrial tissue is found in the ovary, but in a subsequent communication in 1922,<sup>12</sup> he propounded his theory of retrograde menstruation and cellular spill. During menstruation, some of the menstrual blood with its normal content of endometrial fragments may pass backwards through the Fallopian tubes and reach the pelvic peritoneal cavity. Arrived there, the fragments implant themselves on the serous surface either because of their inherent powers of growth or because the peritoneum has been damaged by the irritant action of the menstrual blood. The majority of the fragments attach themselves to the pelvic organs and anterior and posterior cul-de-sac, but the movements of bowel and bladder make a much wider dissemination possible and readily explain the occurrence of endometrial tissue in situations as far removed from the pelvis as the umbilicus.

That retrograde menstruation and cellular spill do occur is within the experience of every abdominal surgeon who at some time or other must have seen blood dripping from the abdominal ostia or the serous surfaces of the pelvis splashed with purplish endometrial implants.

I am a wholehearted believer in Sampson's theory and consider that it is applicable to practically all cases of external endometriosis.

Many gynecologists find it difficult to reconcile the occurrence of umbilical and inguinal endometriosis with a belief in Sampson's theory, but surely this is not difficult if it is remembered that hernial protrusions of the peritoneum are frequently found in these situations.

In my own practice I have had one example of inguinal and one of umbilical endometriosis and in both instances there was extensive endometriosis of the pelvic cavity. Further, the patient with the umbilical lesion had at one time worn a truss for umbilical hernia.

Sampson's views have been widely but not generally accepted, and it is somewhat ironical that his accurate description and logical interpretation of pelvic endometriosis have led to a revival of the serosal theory in opposition to the one which he himself has brought forward.

Robinson<sup>13</sup> has pointed out that the celomic epithelium is the structural source of the generative organs, and he explains the evolution of external endometriosis as a topical awakening of the genetic potentialities in some of the celomic rests. Novak expresses similar views.

The serosal theory has therefore been amplified and has now become the celomic theory but, in spite of its infinite possibilities, I still prefer the one propounded by Sampson as I believe that it offers a more reasonable explanation of the "splashing" of the serous surfaces found in external endometriosis.

Admittedly there are a few pathologic curiosities, such as the brachial endometriosis described by Navratil and Kramer,<sup>14</sup> which neither theory is able to explain satisfactorily but which may conceivably arise as a result of metastatic or embolic endometriosis, either by the lymphatics as suggested by Sampson in 1922<sup>15</sup> and two years later by Halban<sup>16</sup> or by the veins as actually demonstrated by Sampson in 1927.<sup>17</sup>

Having discussed the possible sources of the misplaced endometrium, the factors which favor endometriosis must next be considered.

The most extreme example of endometrial invasion is seen in carcinoma of the body of the uterus. Here the affected mucous membrane proliferates and forms a tumor which may fill the uterine cavity. Fragments may be broken off and implant themselves on the mucous surfaces of the lower genital tract or be carried along the Fallopian tubes and reach the peritoneal cavity. The malignant endometrium may also penetrate and destroy the deeper structures in the uterine wall, and some of the cells may enter lymphatics and blood vessels and be transported to distal organs. Here the invasive powers rest in the altered character of the malignant cell but in the case of endometriosis, in which the sequence of events is similar, there must be some other factor which induces normal endometrium to break its bounds without disturbing its functional activity.

In 1887 Chiari<sup>18</sup> published his observations on salpingitis isthmica nodosa and concluded that the tubal and cornual nodes characteristic of that condition and indistinguishable from adenomyoma were the outcome of a chronic salpingitis. His views were immediately confirmed by other workers but suffered a temporary

eclipse during the ascendancy of von Recklinghausen's Wolfian theory. They were revived, however, by von Franqué<sup>19</sup> in 1900 and from that time onwards the theories of inflammatory causation and mucosal origin became complementary and inseparable.

The inflammatory theory was also linked up with the serosal theory, and as already stated Robert Meyer made it an essential part of his phenomenon of epithelial heterotopy, whether applied to the uterine mucous membrane or to the peritoneum.

In the case of the uterine mucosal growths, Meyer also hinted at the possibility of a mechanical factor when he wrote that, if a mechanical lesion were present such as might be caused by therapeutic means or by gestation or parturition, neither a small muscular interstee open on the mucous aspect nor the interfascicular connective tissue would be capable of offering resistance to the ingrowth of epithelium.

If Sampson's theory be correct, a mechanical factor would certainly appear to be of importance in external endometriosis, as backward displacement of the uterus or distortion of its cavity may favor regurgitation of menstrual blood and certain diagnostic and operative procedures actually propel some of the uterine contents into the peritoneal cavity.

The uterine endometrium differs from all other mucous membranes in that it passes through the different phases of the menstrual cycle, and as true endometriosis is never observed unless physiologically active endometrial tissue is present, it is reasonable to deduce that the causal factor must be closely related to those which control menstruation.

In a more recent communication Meyer<sup>20</sup> has ascribed uterine endometriosis to basal glandular hyperplasia, his view being that the basal layer of the endometrium, the matrix for the regeneration of the mucous membrane after the more superficial layers have been cast off during menstruation, frequently becomes hyperplastic in response to the monthly calls made upon it, and in certain cases, may exceed its physiologic limits and invade the uterine wall. He believes that the invasive powers rest in the peculiar cellular stroma which is able to exercise a histolytic action on the structures penetrated in a manner which foreshadows malignancy in a mild way.

Other observers, however, believe that the basal layer undergoes little change during the menstrual cycle and if this be so one might reasonably look upon it as an inert barrier lying between the actively proliferating layer and the subjacent muscle. Such a barrier might become less efficient or cease to exist as a result of injury, inflammation or an excess of the normal hormone stimulus.

In the paper already quoted Robinson expresses the view that the cause of endometriosis is an excess of ovarian hormones which under certain biologic conditions stimulate the dormant celomic rests to adenoid formation. The latter also respond in a functional way as expressed clinically by menorrhagias and metrorrhagias, by the forma-

tion of tarry cysts in the ovary, and by the periodic enlargement and shrinkage of the adenomata at the beginning and at the end of the menstrual period.

The follicular hormone is responsible for the proliferative phase of the menstrual cycle and when secreted in excessive amounts as in metropathia hemorrhagica produces an exaggeration of the hypertrophic changes characteristic of this phase and also some degree of endometriosis. With these facts in mind Jeffcoate and Potter<sup>21</sup> examined the clinical and pathologic material from 111 cases of pelvic endometriosis and in the great majority were able to find evidence of follicular overactivity.

They concluded that endometriosis is analogous to hyperplasia and is produced by excessive production of estrin irrespective of the primary source of the endometrial elements.

In summing up the question of etiology, I would say that in the majority of cases the theories of Cullen and Sampson adequately explain the source of origin of the endometrial elements, that trauma and inflammation may be predisposing factors but that the exciting cause of the invasive process is probably to be found in an excessive secretion of the hormone responsible for endometrial proliferation.

The naked eye and microscopic appearances of endometriosis are unmistakable.

In the case of the uterus, whether the endometriosis be internal or external, there is a diffuse or nodular thickening of the muscle wall composed of hyperplastic fibromuscular tissue and seams or islets of endometrium. The presence of the latter distinguishes the tumor from a fibromyoma as also does the absence of a capsule.

The two most important varieties of internal endometriosis are the diffuse lesion in which one wall of the uterus is affected and the organ uniformly enlarged, and the cornual in which the fundus is lopsided or saddle-shaped.

My cases of internal endometriosis include nine diffuse and twelve cornual lesions, but there were probably others which escaped recognition.

In external endometriosis the earliest manifestation is the presence of a number of minute purplish blood cysts or implants on the surface of the pelvic organs and in the anterior and posterior cul-de-sac.

The subsequent life history of these implants depends first of all on their proliferative activity and second on their situation. The ovary and pouch of Douglas are the most favorable sites for continued growth and the majority of lesions of clinical importance are to be found in these situations. Sampson early recognized the frequency and importance of ovarian endometriosis and regarded the ovary as a sort of incubator or hotbed. There is no doubt that conditions in the ovary are peculiarly favorable for the further development of the implants



and possible reasons for this may be its sheltered position when the uterus is retroverted, the proximity of the fimbriated end of the Fallopian tube, the absence of a serous covering, the monthly breach of surface continuity associated with ovulation, and the (possibly) greater concentration of estrin in that organ.

Endometriosis of the ovary results in the formation of the well-known perforating hemorrhagic cyst described by Sampson and now recognized as one of the most important lesions with which the pelvic surgeon has to deal. In the early stages the affected ovary is adherent and on separating it a small quantity of black, treacle-like material escapes. Its surface appearance is not much altered except for some dilated vessels which run in parallel lines across the hilum, but on bisection it will be found that a considerable amount of the interior has been excavated by the invading and secreting endometrium. One might compare the ovary at this stage with an apple which has become rotten at the core, although apparently quite sound externally.

Later the ovary becomes distended with the products of endometrial activity and forms a considerable tumor adherent to the posterior surface of the uterus and other adjacent structures.

In early cases the misplaced endometrial elements are readily demonstrated, but when the entire ovary has been converted into a cyst this becomes more difficult. The naked eye appearances of such cases are quite unmistakable, however, and provide sufficient evidence on which to base a diagnosis of endometriosis.

Next in importance is the pouch of Douglas and the preference shown for this site is probably due to the fact that endometrial fragments gravitate there and are then less likely to be disturbed by intestinal movements.

The most characteristic feature of endometriosis in this situation is the tucking up of the rectal wall to the back of the uterus. Nodules are also palpable in the affected area, and there may be considerable thickening of the uterine and rectal walls.

Implants are also frequently observed in the uterovesical pouch, but they rarely give rise to lesions of clinical importance.

External endometriosis of the uterus is an almost invariable accompaniment of ovarian and rectovaginal endometriosis and in exceptional cases may be the most important lesion. It varies in degree from a mere roughening of the surface to which adjacent structures have been adherent to a palpable tumor closely resembling a fibroid and liable to be mistaken for it unless carefully examined.

External endometriosis may also involve other structures either adjacent to those already mentioned or more distant but as they are all variations of the same theme they need not be described separately.

In my own series of 241 cases of external endometriosis, one or both ovaries were involved in 103, the rectovaginal space in 62, and the



ovaries and rectovaginal space in 71. In the remaining five cases the lesions were in other situations. The ovaries were therefore affected in over 70 per cent of all cases.

I have met with the following unusual examples of endometriosis:

- a. Both ovaries, pelvic colon and appendix, the last named being adherent close to the right ovary.
- b. Ovary and laparotomy scar, operation for acute appendicitis fifteen years previously.
- c. Left ovary and uterine cornua, the right ovary and both Fallopian tubes removed ten years previously for pyosalpinx and tuboovarian abscess.
- d. Ovary, rectovaginal space and small intestine, the last almost obstructed in several places.
- e. Ovaries, uterus, bladder, and inguinal canal, the ureters obstructed and dilated.
- f. Ovaries, uterus, rectovaginal space and umbilicus.

Pelvic infection and newgrowths of the uterus and ovaries, either benign or malignant, may be complicated by endometriosis, but with the exception of uterine fibroids their association is too rare to be anything but accidental.

With fibroids it is quite otherwise and I found these tumors present in more than one-third of the cases of external endometriosis. This fact may be interpreted in three ways: the fibroids may represent the irritative reaction to a preceding endometriosis as suggested by Sampson, both fibroids and endometriosis may be produced by the same hormonal stimulus, a view put forward by Jeffcoate, or the presence of fibroids may predispose to retrograde menstruation and endometriosis by displacing the uterus and distorting its cavity.

As regards more remote sequelae, Sampson has observed malignant tumors of the ovaries and peritoneum which appear to have originated in benign endometrial implants<sup>22</sup> and more recently Frankel and Schenk<sup>23</sup> have suggested that all ectopic pregnancies are due to implantation of the zygote on misplaced endometrial tissue.

#### THE CLINICAL PROBLEM

The importance of the clinical problem rests on the fact that every woman is exposed to the danger of endometriosis during the reproductive period of her life and that the lesions which may result are of a diffuse or infiltrative character and except in their early stages not readily amenable to conservative treatment.

Further, endometriosis seriously interferes with the conservative treatment of other conditions such as uterine fibroids with which it is so frequently associated.

To appreciate the extent of the problem, it is necessary first of all to obtain some idea of the incidence of endometriosis and then to assess the damage which it may inflict on the patient's general health and reproductive function.

Minor degrees of both internal and external endometriosis are no doubt extremely common but unless the patients complain of symptoms which require surgical treatment the condition is not likely to be recognized at this early stage.

From an examination of his pathologic material O. Frankl<sup>24</sup> is of the opinion that internal endometriosis is met with about one-twelfth as frequently as uterine fibroids. In the pathologic department of St. Mary's Hospital, Manchester, during the ten years 1926 to 1935, the relative frequency of the two conditions was as one to seventeen, there being 137 specimens of internal endometriosis and 2,358 of fibroids.

Thanks mainly to Sampson's work it is now recognized that external endometriosis occurs much more frequently than the internal variety.

In the St. Mary's Hospital series just referred to, the external endometriosis-fibroid ratio was one to six. The figures for my own cases over a period of ten years give a ratio of one to four and this is probably a more accurate estimate, as pathologic specimens are not always available when the rectovaginal space alone is involved.

Sampson called attention to the frequency with which pathologic lesions arising from endometriosis of the pelvic peritoneal cavity are encountered during abdominal operations and stated that he had found them 37 times in 170 abdominal operations performed for pelvic conditions between thirty and fifty years of age.

Excluding minor degrees of no clinical importance, I have met with 241 cases of external endometriosis in eleven and a half years, a figure which represents about 10 per cent of all abdominal operations performed by me during that period.

To sum up, it may be said that for every 100 cases of uterine fibroids there are 6 cases of internal and 25 cases of external endometriosis and that the latter is met with as the principal lesion or as an important complication in not less than 10 per cent of all abdominal operations on the female genital organs.

To determine the influence of endometriosis on the patient's general health, it is necessary to consider the frequency and severity of the principal symptoms, abdominal pain, menorrhagia, dysmenorrhea, and dyspareunia.

Pain in the lower abdomen is an important symptom of endometriosis, both internal and external, and may be the chief symptom of complaint.

Recently, I saw a patient who was prostrated by recurring attacks of acute abdominal pain, having no relation to the menstrual period. Radiologic investigation of the alimentary and urinary tracts had already been carried out but the results were negative. On examining her pelvic organs bimanually, I was able to make out some asymmetry of the uterine fundus and therefore decided to explore the abdomen.

The lesion was found to be an endometriosis of both uterine cornua and removal of the uterus resulted in a complete cure.

Menorrhagia or epimenorrhagia is complained of in about 40 per cent of the cases and may be extremely severe, especially if the uterus is involved. That the excessive loss is not due to associated fibroids is shown by the fact that the incidence of fibroids in those patients who complained of this symptom is very little higher than that for the whole series.

Dysmenorrhea, particularly if of recent origin is undoubtedly the most characteristic symptom of endometriosis but is only present in rather less than half of the cases. Frequently, it is of great intensity and becoming progressively worse. The pain may be referred to the hypogastric or sacral regions or to one iliac fossa. In the latter event the corresponding ovary is usually involved but occasionally the lesion is situated in the uterine cornu of that side.

Miles Phillips<sup>25</sup> has described a series of these cases and my own observations confirm his view that a cornual endometriosis is a rare but important cause of unilateral pain at the menstrual periods.

Dyspareunia may be an extremely troublesome symptom and cause the patient much pain and mental distress. It is met with in its most severe form when the endometriosis involves the structures behind the posterior vaginal fornix.

Other symptoms, less frequently complained of, are "shooting" or "electric" pains in the vagina, pain in one or other leg, difficult or painful defecation, and constipation sometimes amounting to chronic or even acute intestinal obstruction.

I have met with severe degrees of pelvic endometriosis which were almost painless but this is exceptional; on the other hand the pain is frequently so severe that the patient is willing to undergo any treatment, however, radical, in order to obtain some relief.

The next point for consideration is the influence of endometriosis on fertility, and in this connection it is important to consider the age incidence of the disease. In my own series of cases, 88 per cent were operated upon between the ages of thirty and fifty, 28 per cent under thirty-five and 10 per cent under thirty. Twenty per cent of the patients were single.

Excluding cases in which there were associated uterine fibroids, single women, and women who had been married less than three years, 40 per cent of the remainder were sterile, 32 per cent had not been pregnant for at least ten years and 23 per cent for at least five years.

These figures prove that endometriosis has a serious adverse influence on fertility. No doubt ovarian dysfunction is partly responsible for this, but I think the main cause is the severe and infiltrative character of the lesions produced by the misplaced endometrium.

I now come to the treatment of endometriosis. When the lesions are extensive, this must be radical and either surgical or radiologic. I

have very little experience of radiologic treatment and prefer to remove the uterus, preferably by total hysterectomy together with both appendages. It is unnecessary and, in fact, dangerous to dissect out growths from the bowel wall, as these will retrogress after the ovaries have been removed.

One of my patients had chronic intestinal obstruction from the presence of two endometriotic lesions in the ileum, but the obstruction completely disappeared after the uterus and appendages had been removed. Alfred Gough<sup>26</sup> has also reported a case in which acute intestinal obstruction was produced by a lesion involving the rectal wall. The uterus and appendages were removed and a temporary colostomy performed, but it was possible to close the latter within a short time and the patient has now completely recovered.

In less severe cases and particularly in younger women, treatment should, if possible, be conservative, but it must be realized that this may only relieve the symptoms for a time and have to be followed at a later date by a more radical operation.

As far as I know only two of my patients have become pregnant after conservative treatment, and a considerable number have not obtained complete relief.

The abdominal operations performed in my own series were as follows:

Total hysterectomy with both appendages	107
Subtotal hysterectomy with both appendages	98
Total hysterectomy with one appendage	6
Subtotal hysterectomy with one appendage	17
Subtotal hysterectomy, appendages not removed	6
One appendage removed	14
Other conservative operations (excision of nodules, etc.)	14
Total	262

There were three deaths, one from peritonitis and two from embolism, an operative mortality of a little over 1 per cent.

Some ovarian tissue was left behind in 21 per cent of the cases, but true conservative treatment, that is to say treatment which does not interfere with subsequent pregnancy, was possible in only 10 per cent. If patients over thirty-five years of age are excluded, however, this percentage is 30 in 83 cases.

The average person's reaction to these figures will probably be one of surprise that so many radical operations were considered necessary, but it must be remembered that to be successful, conservative treatment should not only conserve function but also cure the disease. Many keen advocates of conservative surgery are likely to forget this in their anxiety to preserve the reproductive organs.

I must confess, however, that the radical nature of the surgical treatment of endometriosis depresses me when it becomes necessary

in women under thirty-five years of age, but the only solution is either to prevent the occurrence of endometriosis or to diagnose the lesions at an earlier stage of their development.

If endometriosis be the result of ovarian dysfunction, it may be possible to recognize the latter by its effect on the menstrual cycle, and when clinical endocrinology has advanced to the stage when the specific hormones can be used with precision, to successfully treat it.

In the meantime it should be possible to reduce the incidence of external endometriosis by treating conditions such as subinvolution, backward displacements of the uterus, and uterine fibroids, which may predispose to retrograde menstruation, and by carrying out the various intrauterine diagnostic and operative procedures at a time and in a manner least likely to drive fragments of endometrium into and through the Fallopian tubes.

The present-day custom of advising girls to lead a normal and active life during the menstrual period is open to objection for the same reasons, and it is quite possible that some of the pelvic endometriosis met with today is due to woman's emancipation and her determination to ignore or minimize the handicap of the menstrual function.

The other alternative is to operate on cases at a stage when it is possible to excise or destroy early lesions in the ovary or elsewhere. Small implants can be cauterized, nodules in the rectovaginal space dissected out or the affected part of the ovary resected. I have read of so-called tarry cysts being shelled out from the ovary, but I doubt if this is ever possible, as a true endometriosis eats away the substance of the ovary and cannot be enucleated.

Conservative treatment of this kind is only possible if a correct diagnosis is made early in the course of the disease, and this necessitates a proper appreciation of the importance of such symptoms as acquired or increasing dysmenorrhea, particularly if associated with menstrual irregularity, pain in the vagina or on defecation, and high dyspareunia.

Recognition of the characteristic physical signs is equally important, and the earliest of these is either some diminished mobility or some asymmetry of the uterus. The presence of a nodular swelling behind the cervix is usually conclusive evidence of endometriosis in that situation, but occasionally small fibroids adherent in the pouch of Douglas may confuse the diagnosis.

Dysmenorrhea or dyspareunia of recent origin should always arouse a suspicion of endometriosis, and in the absence of well-marked physical signs be sufficient to warrant a careful examination under anesthesia or even an exploratory abdominal operation.

I have dealt with the problem of endometriosis in its pathologic and clinical aspects and have endeavored to stress its importance from the



social point of view. For the proper appreciation of this fact we are mainly indebted to the brilliant researches and painstaking observations of John A. Sampson, and on this, my first visit to the United States, I would like to give expression to the respect and admiration which I feel for his work and which I know are shared by every British gynecologist.

## REFERENCES

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## IMPROVEMENTS IN THE OPERATIVE TREATMENT OF CARCINOMA OF THE LARGE BOWEL\*

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THE general principles underlying the operative treatment of carcinoma of the large bowel are not new. The perineal approach used in the primitive operations of Faget in 1739, Lisfranc in 1826, and in the improvements of Cripps and Allingham and others, was continued in the more radical method of Kraske of 1885. The inadequacies of the Kraske operation led to the preliminary colostomy of Schede in 1887, then to the deliberate combined abdominoperineal resection with perineal anus of Maunsell in 1892 and finally to the combined operation with abdominal colostomy of Quéno in 1896. Since this time the many operations for cancer of the rectum and rectosigmoid which have appeared over the names of various surgeons have been largely modifications or repetitions of work previously done.

Likewise the principles underlying resection of the colon with exteriorization are old, having been devised by Bloch in 1892 and especially by Paul in 1895. Mikulicz popularized the procedure, and while

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he did not claim priority his name has remained attached to the method since his paper of 1902. Upon the broad foundations laid by these and other surgeons there is still much room for technical improvements.

Perineal colostomy long in disfavor with surgeons but invariably requested by the patient is advantageous if properly performed. The widely used Kraske operation left such a train of stenotic and cicatricial anal openings through which, to the disgust of all concerned, the overflow from a distended colon dribbled almost constantly, that the perineal opening acquired undeserved opprobrium. As the great mitigating factor in enabling one to endure an abdominal colostomy is the adequate emptying of the colon at fairly regular and infrequent intervals, it seems logical that this should apply also to the perineal opening. But the perineal opening commonly became strictured because the bowel of which it had been formed was avascular and had sloughed away. Clearly it is very important to bring viable bowel to the perineum. But this may require not only ligation and division of the superior hemorrhoidal and inferior mesenteric vessels but in certain cases the partial mobilization of the descending colon by dividing its peritoneal attachments, in order to free 12 to 15 cm. of living bowel to reach from the pelvic brim to and through the pelvic floor. Obviously such mobilization cannot be carried out through the perineum and in any case the surgeon should determine the line of demarcation between vascular and avascular bowel by the transition from pink to leaden color and from pulsating to nonpulsating vessels. Many surgeons have devised methods to constrict or obstruct the artificial anal opening not appreciating the advantages of an open orifice. If the perineal anus is large and open, then about three months after operation, a more regular evacuation is established. There is more complete and less frequent emptying of the colon and usually a five- to ten-minute warning of the approaching defecation develops. Some of the patients find that a saline enema every two or three days gives them an interim of almost complete freedom, others that a small amount of a sodium or magnesium sulphate or similar laxative (not mineral oil) taken in cold water on arising will immediately after breakfast so empty the colon that they may then go twenty-four to seventy-two hours without evacuation, when the procedure must be repeated. Most of the patients avoid the more laxative foods and wear a rather small pad and T-bandage, others find a minute plug of cotton adequate. A few despite the loss of sphincters eventually find it unnecessary to wear any protection over the opening. Rarely is a secondary operation for better control requested.

As the perineal opening made with viable bowel is convenient and greatly preferred by the patient, we have not for seven years used a permanent abdominal colostomy in any case of removable cancer of

the large intestine. For growths of the rectum and rectosigmoid, we usually employ a one-stage combined proctosigmoidectomy. Through a left rectus incision, under spinal anesthesia, the sigmoid and rectum with adjacent peritoneum and tributary lymph glands are liberated to the floor of the pelvis and the superior hemorrhoidal and inferior mesenteric vessels are divided, between double ligatures. In no way is the very radical nature of the operation compromised. The lower level of viability of the sigmoid having been determined by color and arterial pulsation, a long folded gauze tape is tied about the bowel at this point. If necessary, restraining peritoneal attachments to the descending colon are sufficiently divided that viable sigmoid may be brought to the perineum. No attempt is made to form a pelvic diaphragm or to peritonize denuded surfaces, experience having shown such procedures to be unnecessary. The tape having been packed against the pelvic floor, the abdominal incision is closed. Through a median postanal incision the tape and the attached loop of bowel are withdrawn. Dressings are applied, the cancerous loop then amputated and a rectal tube tied into the end of the sigmoid. A week later the two partitions between the terminal sigmoid and anus are divided and the mucous edges united with fine wire sutures so that a single opening is formed. If the pelvic floor or anus has been invaded by the cancer it is widely excised and removed attached to the rectum and segment of sigmoid.

A second method adapted to anterior rectal growths which are adherent to or have invaded the prostate is, after completing the abdominal portion of the operation, to turn back a flap from the anterior perineum similar to that used by Young for prostatectomy, and deliver and excise the diseased loop of bowel. The proximal end of the sigmoid is then brought out through the split anus, after which the perineal wound is closed. Despite these extensive operations the patient may not infrequently be permitted out of bed by the tenth day, and to go home with a small superficial granulating wound area by the fourteenth day.

If when the tissues about the cancer are reached, they are found to be indurated and adherent, one may suspect a perirectal infection. The abdominal part of the operation should then be terminated and the liberation of infiltrated tissue completed from below to reduce the danger of peritoneal contamination.

Oblique muscle splitting incisions we have found of great advantage in the excision of the cecum, ascending colon, hepatic and splenic flexure, and the descending colon. As a rule the incision follows the line of one of the lower intercostal nerves, splits the external oblique and in part the transversalis muscle, divides the anterior and above the linea semilunaris, the posterior sheath of the rectus abdominis which muscle is usually retracted or may with the internal oblique

be more or less freely divided. Such incisions carried forward from the lateral border of the erector spinae give excellent access to deeply attached and rather inaccessible portions of the colon, leave a strong well innervated abdominal wall and, without additional incision, are convenient for the exteriorization of the deeply attached bowel, or a colostomy.

Leakage after intestinal anastomosis has been a common cause of death. Interference with the blood supply, the fatty encasement of the colon, inadequate methods of suture, back pressure, and infection have led to many preventable fatalities from this cause. Peritoneal vaccination is of little avail when the peritoneal cavity is inundated with intestinal contents, and the usual drains are quite inadequate. We have therefore resorted to very large (2.5 to 6 cm.) glass tube (lamp chimney) drains with well-rounded lower edges, which in case of doubt are anchored over the suture line (as in an ileotransversostomy) with fine alloy steel wire sutures. If the suture line breaks down, the flood of intestinal contents has then free passage externally. If inspection shows the tissue to be alive and progressively healing, the anchoring sutures are cut and the tube slipped out two to four days after the operation.

Sutures should give adequate water tight coaption without devitalization or undue tissue reaction. Catgut is unreliable as to duration of support, favors adjacent necrosis, and when used for the inner row, should be reinforced by an outer row of silk or fine alloy wire. The wire is least irritating even in a septic field. No absolutely aseptic method of suturing the colon or ileum has yet been devised, although many, such as with the Rankin or Furniss clamp eliminate gross contamination. Bacteria are forced through the intestinal wall by the compression of clamps and are carried from mucosa and Peyer's patches by sutures.

#### IMPROVEMENTS IN THE MIKULICZ OPERATION

We have been able to reduce the mortality and morbidity of this operation by (a) suturing the *antimesenteric* sides of the arms of the loop to avoid inclusion of mesenteric blood vessels, a cause of fatal necrosis of the bowel; (b) closing the wound about the exteriorized loop of bowel, applying dressings and immediately cutting away the diseased bowel; (c) tying bulbous glass tubes in the protruding ends of the bowel external to the skin level, to avoid obstructive symptoms and pressure perforation into the peritoneal cavity from indwelling glass or rubber tubes; (d) division of the spur by incision with immediate follow-up suture of the margins with interrupted 35 gauge alloy steel wire sutures, eight to fourteen days after the first operation. This requires no anesthetic or special preparation and saves the patient the days of discomfort occasioned by the crushing clamp; (e) the inversion

and suture of the bowel edges also with fine wire sutures at the time of, or six to ten days after, the division of the spur. To avoid a spreading subcutaneous pyoderma, the skin should not be sutured until the wound is covered with healthy granulations. In most of the cases the residual wound soon closes spontaneously. Occasionally it is possible to have the enterostomy openings entirely closed and the patient out of bed fourteen days after the first operation.

Prevention of skin irritation from open enterostomy wounds in our experience has been best obtained by (a) air exposure of wound under a bed cage and incandescent lamp, associated with frequent drying of the skin and a thick dredging with zinc stearate power; or (b) if skin has not been irritated, the cementing of a sheet of rubber dam with an appropriate hole cut in the center, to the abdominal wall with a nonirritating rubber cement. In any case ointments, oils, or retentive or macerating dressings should not be used.

Decompression of the bowel in case of obstruction is essential before any attempt is made to liberate or remove the diseased section. With the distention of obstruction, the bowel becomes permeable to bacteria, a peritonitis results which may be exacerbated to death if any extensive intraabdominal manipulation is then attempted. The obstruction is often precipitated by cathartics or heavy residue in the diet and frequently may be relieved by continuous duodenal and rectal aspiration drainage, or if there is no improvement within six hours, an appendectomy or enterostomy should be done. An appendicostomy on a thin patient necessitates only a one or one and one-half inch muscle splitting incision. No sutures or ligatures are used; dressings are applied around the exteriorized appendix and mesoappendix, the tip then cut off and a small catheter threaded into the cecum. By repeated injection and aspiration of saline, the colon then can gradually be decompressed. Daily, the indwelling catheter is replaced by one of larger size so that by the end of a week a 26 or 28 rectal tube is in place. Unfortunately, many appendices after middle life are too small to be thus used, and the side of the cecum should then be drawn through the incision, clamped, surrounded by gauze and a tube sutured in place. After the decompression it is wise to wait about three weeks for the peritonitis to completely subside before the final operation.

The Mikulicz operation may occasionally be used for rectosigmoid growths, where there is a fairly long rectum. After free mobilization to the pelvic floor, the diseased segment is removed. The distal end of the bowel should be held securely above the skin level in a strong clamp (as in the obstruction sigmoidoscopy) and into the proximal end of the bowel a bulbous glass drain is tied. Care should be taken not to incur such tension upon the loop as to cause the bowel to snap back into the pelvis before supporting adhesions have formed. A week

or more later the spur is divided and sutured and when local conditions permit, the intestinal opening completely closed with interrupted sutures of fine alloy wire.

For advanced inoperable carcinoma, we find colostomy rarely desirable. By restricting the patient to a nonresidue diet, by avoiding drastic cathartics, by the use of mineral oil, enemas, and a resort to duodenal and rectal siphonage if obstruction develops, the necessity for the operation may usually be avoided. For the patient who is completely obstructed and at the most has only a few weeks to live it is, as a rule, better to let him die obstructed than to render him more repulsive and a greater burden to himself and friends through a colostomy. In the earlier stages when small irremovable metastases are present in the liver or lymphatics, the radical removal of the diseased bowel without colostomy is often a preferable operation. Several of our patients with hepatic involvement have lived from one to three years in relative comfort after removal of the primary tumor.

Peritoneal vaccination to develop more or less immunity to bacterial contamination before resecting the bowel, has been largely used, especially at the Mayo Clinic, where injections of killed streptococci and Bergen's bacillus were first advocated by Rankin and Bergen. While still employed in this clinic Rankin has in recent years expressed doubts as to its value. It is our impression that the mixture devised by Steinberg may have a greater value. There seems to be little question that complete recovery from a previous peritonitis resulting from colonic obstruction, intestinal leakage, or a previous operation markedly reduces the danger of a fatal postoperative peritonitis.

#### MORTALITY

The mortality from the resection of the large bowel has largely been due to sepsis, the result of leakage, or bacterial dissemination, and hemorrhage. Leakage is a common factor, having as its chief cause an arrest of circulation and secondary necrosis in the retained bowel. Death has occurred from sewing the mesenteric borders of the two arms of the liberated loop of bowel together and thus occluding nutrient vessels. Avascular as well as obstructed portions of the intestine are permeable to bacteria and stagnant blood affords a culture medium in which the bacteria may colonize before swarming out to overcome the peritoneal defenses. Such conditions are especially favorable for pathogenic activity of the *Bacillus Welchii*. Intestinal suture lines, especially in the colon, not infrequently separate followed by flooding of the peritoneal cavity with feces. An end of exteriorized bowel may retract within the abdomen and leak, an indwelling rectal or Paul tube may produce pressure necrosis, perforation, and free leakage. Intestinal clamps often squeeze bacteria through the wall of the bowel. Cancerous tissue is brittle and easily



opened during attempts to free the diseased bowel. Septic areas from malignant ulceration are not infrequently opened during the operation, while cancerous tissue that appears uninfamed often contains virulent streptococci or other microorganisms. Most of these dangerous complications which raise the *general mortality* from resection of the colon to 18 or 20 per cent, may with experience be anticipated and avoided. However, when for these extensive operations aged and debilitated patients and those who have local evidence of the cancer for a year or more are included, a mortality of at least 10 per cent may be expected.

#### SUMMARY

Attention is directed to the advantages of a type of a single stage abdominoperineal proctosigmoidectomy with perineal colostomy or perineal anus, which may hospitalize the patient only two or three weeks. Peritonization of denuded areas in the abdomen and the formation of a pelvic diaphragm of peritoneum have been found to be unnecessary. The chief cause of death is peritonitis resulting from the spread of bacteria from infected tissue about the cancer, and especially the dissemination of bacteria through retained avascular and necrotic bowel, measures to avoid which are mentioned.

In anastomosis of the colon there is need of the more enduring silk or alloy wire sutures and questionable suture lines should be guarded by overlying "lamp chimney" drains.

Oblique muscle splitting incisions are of great advantage in many of the Mikulicz type of resections. The exteriorized loop is best removed at the first stage and tubes tied into the ends of the bowel should remain external to the level of the skin. Incision with follow-up wire suture should supplant the clamp in division of the spur as this enables the bowel ends to be united early and painlessly, saving the patient much discomfort and hospitalization. A modification of the Mikulicz operation may be used for high rectosigmoid growths with the advantage of preserving the normal sphincteric control.

1720 SPRUCE STREET

#### DISCUSSION

DR. LEWIS F. SMEAD, TOLEDO, OHIO.—Very practical improvements have been made in the last few years in the surgery of the colon. We have learned that we must not do radical surgery during acute obstruction; that the circulation of the colon is easily destroyed and proper care must be taken for its preservation; that infection is especially dangerous in these cases and must be avoided by some operative technic which will prevent contamination, or by some form of immunization against the infection; that there must be a careful selection of patients submitted to such radical surgery and that preoperative preparation and postoperative care must be thorough and painstaking; and finally that only very radical surgery will cure carcinoma of the large bowel.



It is well recognized that in operations subsequent to colostomy the peritoneum is not easily infected. It has therefore been the hope of surgeons that this immunity could be produced artificially. Numerous attempts have been made to bring about such an immunity, chiefly by the intraperitoneal injection of bacteria suspended in saline solution. This process takes at least two or three weeks and produces a moderate degree of immunity but only against the type of bacteria injected. It is essential in this connection to understand that the cause of death in peritonitis is the absorption of toxins produced by bacteria while they are within the peritoneal cavity. The bacteria which reach the blood stream from the peritoneal cavity are usually very quickly destroyed, chiefly by the fixed phagocytic cells of the reticulo-endothelial system. The problem then is to develop some general form of protection which will really be efficient against all types of bacteria which may cause acute peritonitis. The phagocytic cells of the blood would seem to offer such a general protection, for they are no respecter of persons and will destroy one organism as well as another. The difficulty has been to get the phagocytic cells into the peritoneal cavity in sufficiently large numbers at the opportune time.

When dead colon bacilli suspended only in saline solution are injected into the peritoneal cavity, phagocytic cells are called out but in insufficient numbers, due to the fact that the colon bacilli remain in the peritoneal cavity too short a time. However, Steinberg found that virulent, killed, colon bacilli suspended in 1.5 per cent gum tragacanth solution were retained much longer in the peritoneal cavity and caused it to be flooded with huge numbers of phagocytic cells over a period of some three days. This has protected animals against massive fecal contamination of the peritoneal cavity which was always fatal to the control animals.

This suspension of colon bacilli in gum tragacanth solution (*colibactragen*) is used in clinical work by spreading it freely through the peritoneal cavity at the end of an operation in which contamination is suspected. The phagocytic cells are present in large numbers within three hours thereafter while the infecting organisms require some eighteen hours to multiply sufficiently to cause trouble. However, long before this most of the bacteria will have been taken up by the phagocytes and are harmless. The cell count of phagocytes in the peritoneal cavity will show a minimum of 90,000 per c.mm. in three hours with a maximum of 450,000 in twelve hours. The clinical results in a considerable number of cases in the hands of several good surgeons have been striking and quite convincing. The earlier preparation, given out for clinical trial, gave severe reactions but the material as now prepared gives very little reaction and acts more quickly.

DR. THOMAS E. JONES, CLEVELAND, OHIO.—There are three serious objections to Dr. Babcock's operation; first, there is danger of interference with the blood supply; second, if one constantly has to worry about the blood supply, there is a tendency to the removal of too little tissue; and third, a large raw surface not peritonized is left in the pelvis.

The chief difficulty from the abdominal colostomy has existed because the surgeon has not taken time to instruct the patient in its care. In the cases I have observed with perineal anus on the other hand there has either been a stricture or too large an opening, with prolapse of the mucous membrane. If the latter occurs there is a lot of mucous discharge, which is very irritating to the perineal skin and requires the patient to wear a perineal pad constantly. Patients who are constricted frequently require dilatation.

Dr. Babcock showed a slide of the Mikuliez procedure for rectosigmoidal carcinoma. I look upon the rectosigmoid not as an area or length of bowel, but simply the point at which the rectum joins the pelvic colon. It is certainly not two inches above the reflection of the peritoneum, and it is impossible to bring that out on the abdominal wall and do a Mikuliez operation.

In order to get some operability and mortality figures upon the combined abdominoperineal operations, I took 100 consecutive cases as they came into the office for examination, starting with July 1 of this year and going back. Ten of these patients went elsewhere for their operation, possibly because I would not do an operation with a perineal anus. There were 20 cases in which I thought it was impossible to remove the growth or where there may have been a metastasis in the liver. That left 70 patients who went to the hospital for operation. They were explored. Ten patients had liver involvement; 3 were inoperable on account of fixation, so that we had 57 completed operations out of the 70 cases. Of the 57 patients there were four deaths (7.2 per cent). Of the 4 deaths only two were due to peritonitis. Judging from the reactions that I have seen following peritoneal vaccine, I would hate to submit 70 patients to the reaction from intraperitoneal vaccination.

DR. BABCOCK (closing).—Impressed by Steinberg's demonstration at our Toledo meeting, I returned with samples of his colibactragen which we have used in a few cases. One result was particularly gratifying. The bowel in this particular case had given way and the peritoneal cavity flooded with fecal material. An associate who was operating poured the bactragen into the cavity and the patient recovered without untoward symptoms.

The one stage proctosigmoidectomy we have described does not sacrifice any radical quality. In some ways it is more radical than the conventional operation with an abdominal colostomy.

As to the mortality we have not as yet equaled the splendid record of Dr. Jones. Taking all cases it has been about 18 per cent, because we have included advanced cases with perforation and perirectal infiltration, recurrent cases and especially because a technic to insure routinely viable bowel to the pelvic floor was not developed early. Eliminating those cases in which septic areas were invaded and those in which through technical error the blood supply to a section of the retained sigmoid had been arrested, the mortality has been well under 10 per cent, and as a rule the convalescence has been very rapid and surprisingly easy. It is evident, however, if the operator fails to free a section of well vascularized sigmoid long enough to reach from the pelvic brim to the pelvic floor (12 cm.), he should finish the operation with an abdominal colostomy.

As to the Mikulicz method for the removal of carcinoma near the rectosigmoid junction, it is to be remembered that the unstretched rectum alone is 12 to 15 cm. long, while the anus measures 3.5 cm. additional. Under traction the pelvic floor is raised and the rectum elongated. Therefore, cancer situated about the level of the pectineal line after the rectum has been freed, may often be lifted through an abdominal incision with 5 to 8 cm. distal bowel to spare. Thus we have been able to leave a number of these patients with a normal perineal anus.

## EARLY DIAGNOSIS OF CANCER OF THE BODY OF THE UTERUS\*

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THE earlier that cancer is diagnosed the greater the chance of cure. Bleeding is recognized as the most common symptom of cancer of the body of the uterus. Closer observation of the character of bleeding at and after the menopause by the patient, and more careful interpretation of the significance of the bleeding by the physician, offer an opportunity for early diagnosis. Two case reports illustrate the benefit to be derived from the cooperation of the patient and physician. A third case illustrates the association of hyperplasia and carcinoma.

Placing emphasis on bleeding does not exclude the importance of other symptoms and examinations. Education of the public through the press and by lectures has focused the attention of women on irregularities of bleeding. An explanation for unusual bleeding is now frequently sought where formerly it was assumed to be a part of the menopause. This is especially fortunate for the cases of cancer occurring near the menopause.

### CASE REPORTS

CASE 1.—Mrs. S. D., forty-four years of age, was slightly obese. The family history was not important. There was no history of cancer. She was married but had never been pregnant. Her menstruations had been essentially normal with an average amount of flow occurring about every twenty-eight days. In May, 1933, she came to the clinic for a general examination because she had headaches, dizziness, low back pain, abdominal distress, constipation, and leucorrhea. For several months there had been some irregularity of menstruation with a prolonged interval followed by a shortened interval and profuse flow. Correction of ametropia relieved the headaches. The low back pain was explained by mild arthritis. The abdominal distress and constipation was accounted for by a functional nervous disturbance with pylorospasm. The leucorrhea was explained by a slight erosion of the cervix. The uterus showed beginning involution and a small fibroid. She was given a chart to record the character of her menstruation (Fig. 1). On account of a subacute bronchitis and ethmoiditis she was treated in another department for the next few months. In November, 1933, there was a profuse flow continuing until Jan. 5, 1934. Calcium was administered orally with some improvement but the flow remained heavy until she returned Feb. 2, 1934. At that time she received

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Photomicrographs prepared and diagnosed by Dr. Frank Hartman, Chief of Laboratories, Henry Ford Hospital.

five daily injections of antuitrin-S. The flow became scant but irregular spotting continued until she was seen on July 27, 1934. She was advised to have a diagnostic curettement but delayed until Oct. 16, 1934 (Fig. 1). The spotting continued during that time. When curetted at that time the cervix was soft and dilated easily. The uterine sound showed the depth of the uterine cavity to be 7 cm. Manipulation with the sound induced bleeding. The curette demonstrated a small submucous fibroid. Some clots and a small amount of endometrial tissue were removed. Frozen sections showed no malignancy but Dr. Hartman reported that the fixed sections of the endometrium seemed to be the seat of a very marked papillomatous growth which should be considered early or borderline malignancy, because of the variation in the size and shape of the cells, and because of the marked activity (Fig. 2). Many of the cells showed clear vesicular nuclei. Mitotic figures were present but not

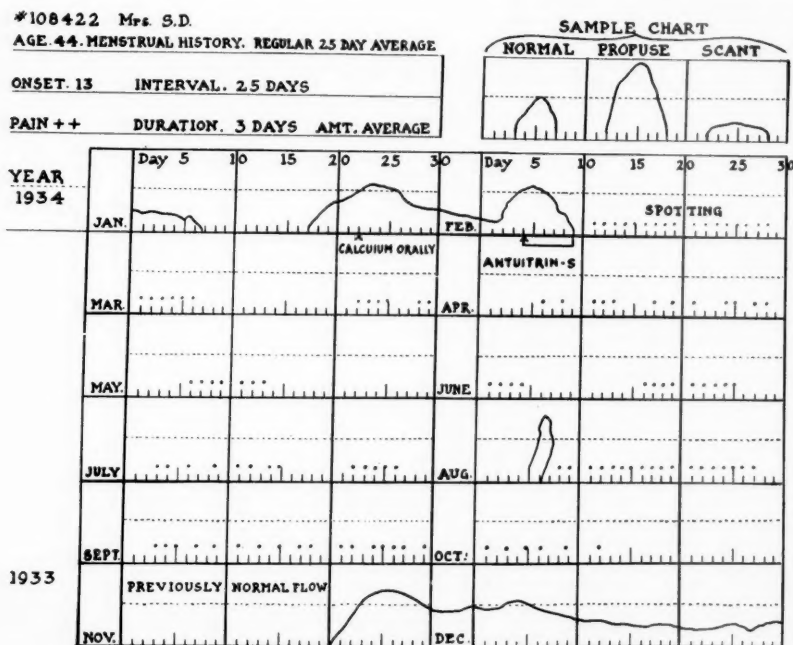


Fig. 1.—A chart given to patients to obtain a graphic record of their menstruations. The sample in the upper right corner is explained to the patient to indicate the method of charting. The dotted line indicates the height of an average amount of flow. The curves drawn on the chart indicate the interval and amount of flow. The dots indicate spotting. This particular chart began in November, 1933 and ended October, 1934. The time of administering medication is shown. While the chart is not scientifically accurate it provides a more accurate record than can be obtained from the memory of a patient. Preceding records by the patient were nearly normal until November, 1933. This was the first metrorrhagia and the first flow continuing longer than seven days.

abundant. There was a great deal of blood but little or no stroma. Radium (4500 mg. hr.) was given. The uterus atrophied. All discharge ceased. There has been no further evidence of the presence of malignancy.

CASE 2.—M. N., a single teacher, fifty-eight years of age, has an important family history because her mother, one sister, and an aunt died from cancer. Her menstruations began at fourteen years of age. The first period was accompanied by a convulsion. She always had dysmenorrhea. The flow was irregular with an interval up to five weeks but usually every twenty-one days. The flow was usually

scant sometimes lasting only one day. Menopause occurred at age of forty-eight years. During the summer of 1933, she noticed a slight yellowish, irritating discharge, probably due to trichomonas infestation. It disappeared promptly after taking douches. During the summer of 1933, she noticed a few specks of blood which were assumed to be from the rectum. She gave a history of a thrombosed hemorrhoid. Nov. 14, 1933, a routine pelvic examination revealed normal involution

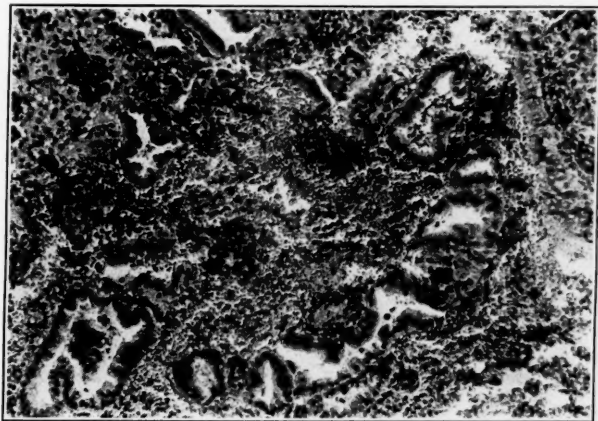


Fig. 2.—Photomicrograph, medium power: section of uterine mucosa removed with a curette, showing irregular atypical glandular alveoli lined by several rows of large columnar cells. The nuclei are hyperchromatic and many of them are undergoing mitosis. In addition to the tumor, there is much blood in this section.

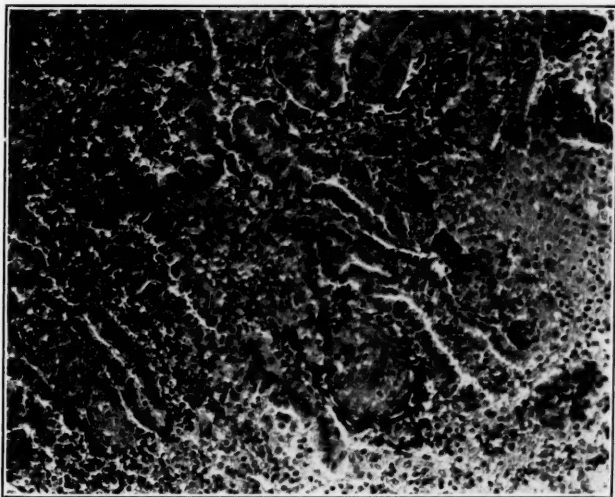


Fig. 3.—Photomicrograph, medium power: section from uterine mucosa removed with curette. Sections show atypical tubular glands lined by several rows of high columnar epithelium. Individual cells are large, having hyperchromatic nuclei and many of them undergoing mitosis.

of the uterus, a normal cervix, no vaginitis, and no discharge. In view of the hemorrhoids and bleeding, a proctoscopic examination was done but nothing found except the hemorrhoids and a small, rectal polyp. She was given local treatment for the hemorrhoids. During the following week the patient continued to notice slight blood stains on her clothing. The patient made some examinations on herself,



and demonstrated that the blood came from the vagina. On Nov. 25, 1933, vaginal examination showed no gross discharge or blood. In view of the patient's family history and her demonstration of the blood having come from the vagina, the vaginal cavity was washed with normal, salt solution. The sediment from this washing

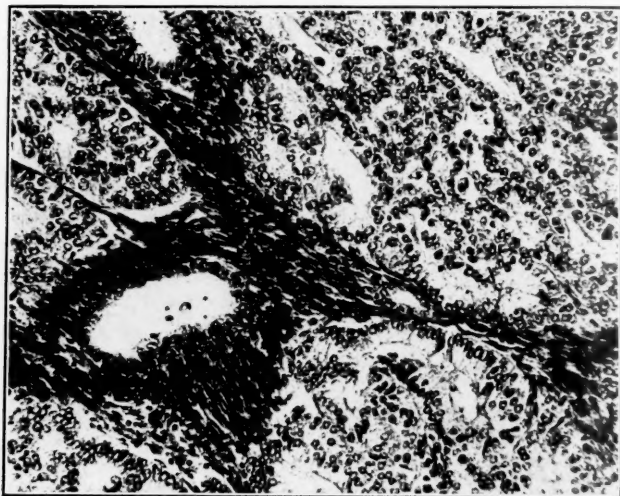


Fig. 4.—Photomicrograph, medium power: section from uterine mucosa showing single uterine gland and carcinoma. The carcinoma is composed of irregular atypical alveoli and solid masses of cells.

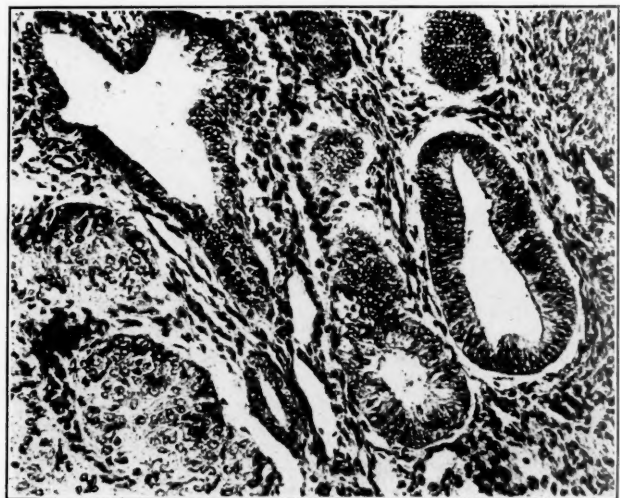


Fig. 5.—Photomicrograph, medium power: uterine mucosa shows irregular hyperplastic glands and solid masses of anaplastic cells representing undifferentiated adenocarcinoma.

showed many red blood cells. The small vagina made it difficult to examine the cervix and she could not tolerate manipulation of the cervix without an anesthetic. A curettement was advised.

On December 9, the uterus was curetted. The fundus was not enlarged. Slight bleeding followed dilatation of the cervix. A small amount of material was removed



with the curette. Microscopic examination of the curettings showed numerous atypical glands separated by a very small amount of stroma (Fig. 3). The glands varied in size. The cells were large and irregular with numerous mitotic figures. The lining cells were more than two layers thick in places. The stroma showed some infiltration, and in some places the cells were grouped in solid masses but in general, an alveolar arrangement was maintained (Fig. 3). The diagnosis was adenocarcinoma of the fundus, Type II. Radium (6,000 mg. hr.) was applied. On Jan. 11, 1934, hysterectomy was performed. The endometrium showed degenerative changes in response to the radiotherapy. In February, deep x-ray therapy was given. There has been no evidence of return of the growth.

CASE 3.—Mrs. M. B., aged sixty-five years, passed the menopause at the age of fifty-two years. Her complaint, on admission, was vaginal bleeding. After the sudden cessation of menstruation at the age of fifty-two, there had been no further bleeding until the age of sixty-four. During that year she had experienced spotting. For three weeks prior to admission, she had continuous flow with two severe hemor-

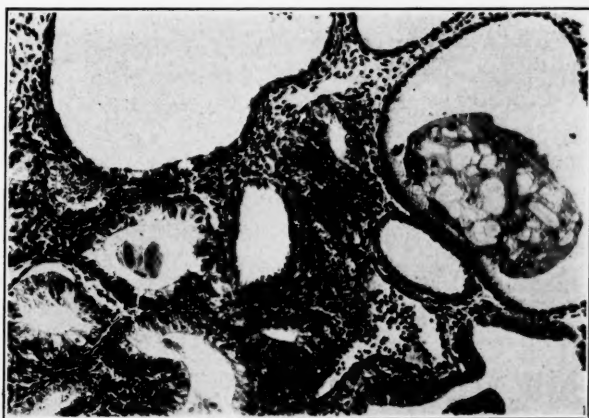


Fig. 6.—Photomicrograph, medium power: section from uterine mucosa shows cystic glands lined by low columnar epithelium, and in one instance containing pink staining debris. In addition there are hyperplastic glands which are relatively small and lined by several rows of high columnar epithelium.

rhages. During this time there was an associated vaginal discharge. A preoperative diagnosis of carcinoma of the fundus was made from the history and the enlargement of the fundus. Hysterectomy was performed and the diagnosis confirmed. Photomicrographs showed typical anaplastic adenocarcinoma (Fig. 4), transitional areas of hyperplasia of the endometrium (Fig. 5), and hyperplasia in an atrophic endometrium (Fig. 6).

#### DISCUSSION

The value of a graphic record of menstrual irregularity during the menopause is illustrated by Case 1. The record was requested as a part of a study to determine the normal limits of irregularities of flow during the premenopause and through the menopause. At the time the chart was started, there was no suspicion of malignancy and probably one existed, since the specimen obtained later showed a very early malignancy.

Other types of charts might be equally effective. This one (Fig. 1) is easily understood by an intelligent patient. Explanation of the sample in the upper right hand corner with a statement that the dotted lines represent the height of an average amount of flow enables the patient to produce an informative record. The data obtained in this manner are more reliable than vague statements by the patient according to her recollection. Keeping the record fixes the attention on obtaining accurate data. Many instances are recorded that otherwise would soon be forgotten. Failure to return the chart usually means that the record is essentially normal. Review of the chart with the patient tends to allay her fears rather than to create fear.

In the interpretation of irregularities of bleeding during the menopausal period, continuous flow whether small or large is particularly significant. Continuous flow may be considered a definite indication for diagnostic curettement. Irregularity in the interval or amount of cyclic flow during the premenopause is common. Transition from the cyclic to continuous flow should always arouse suspicion. Adequate standards for the normal cycles during the premenopausal period have not been established, therefore, aberrations of flow are difficult to define. Failure of the cyclic nature of the flow cannot be considered normal. Hot flushes and other symptoms which establish the diagnosis of the menopause do not justify attributing bleeding to the menopause and excluding the possibility of the presence of malignancy. Cessation of bleeding following the use of calcium or antuitrin-S for any considerable period is not expected if malignancy is the cause.

The relation of hyperplasia of the endometrium to adenocarcinoma of the body of the uterus is often difficult to determine. Bleeding is a symptom common to both lesions. The frequent occurrence of abnormal bleeding near the menopause complicates the clinical diagnosis and demands an explanation. The most experienced pathologists find difficulty in classifying the borderline cases. Whether both lesions exist in the same uterus is controversial. Reports in the literature vary from a high percentage (Novak) to none (Burch). Definition of what constitutes hyperplasia explains some of the differences of opinion concerning the relation of hyperplasia of the endometrium to cancer.

Novak and Yui reviewed 12,813 specimens of endometrium among which they found 804 hyperplasias and 104 adenocarcinomata. Among the 804 cases, 14 revealed "evidence of proliferative tendencies which may even simulate cancer." In 40 of the 804 cases, hyperplasia was found long after the menopause. Coexisting hyperplasia was found in 25 of the 104 adenocarcinomata. They maintain that the persistence and relative excess of estrone predispose to cancer.

In reviewing 594 specimens of hyperplasia, Payne found 13 carcinomata. In 496 premenopausal hyperplasias he found 8 carcinomas (1.6 per cent), with only 1 cervical carcinoma (0.2 per cent). In 38 postmenopausal hyperplasias there were 4 carcinomas of the fundus (11 per cent).

In 152 cases of adenocarcinoma, Taylor found 15 with definite histologic evidence of an associated hyperplastic condition of some type, but he believes that one cannot speak in terms of percentages, since it is obvious that many cases are so advanced that possible benign preexistent lesions have been completely displaced by carcinoma. In his series, he noted 5 instances of diffuse endometrial hyperplasia associated with carcinoma.

Opinions differ concerning the association of myoma and adenocarcinoma of the uterus. In general, carcinoma is found more frequently in the myomatous than in the normal uterus.

Oesterlin and Cron cite some of the cases reported in the literature. Among their own cases, they found in 17,030 tissue examinations that 531 or 3 per cent concerned myoma. Fundal cancer and myoma were found together in 10 cases or 1.9 per cent of all myomas. The 10 cases represented 25 per cent of the fundal cancers. Compared with fundal cancer, they found myoma associated with cervical cancer in only 0.19 per cent.

The presence of myoma in a uterus offers some difficulty in excluding a diagnosis of carcinoma. Bleeding resulting from preexisting myoma may mask the symptoms of carcinoma. The myoma may obstruct the uterine cavity to make a thorough curettement difficult or impossible. The absence of carcinoma in the curettings should not be taken as final proof that carcinoma is not present.

The occurrence of carcinoma in endometrial polyps has been frequently reported. Bleeding is a common symptom of uterine polyps. Benign and malignant polyps may exist in the same uterus. Removal of a single polyp should be followed by a thorough curettement to exclude other polyps.

Bleeding is the most common symptom of adenocarcinoma of the body of the uterus. Review of the clinical records of 71 cases indicated the presence of bleeding, varying from microscopic to gross in every one of them. The character of the bleeding differs in the pre- and postmenopausal patients.

In a review of the literature, Wittenbourg and Zlatmann found that the incidence of postmenopausal bleeding due to cancer ranged from 26 to 92 per cent. In their own cases, 41 per cent was due to cancer of the uterus or ovary, while only 7 per cent was due to benign tumors. Of 1,797 cases of uterine hemorrhage occurring before, at, or after the menopause, Norris reported 20 per cent due to malignant tumors. Of the postmenopausal hemorrhages, 52.9 per cent were due to cancer.

The amount of the bleeding is not an accurate indicator of the extent of the lesion. Case 2 shows the importance of observing microscopic bleeding. The common causes of bleeding during the cancer age, besides carcinoma, are myomas, hyperplasia and polyps. The

frequent association of two or more of these conditions necessitates consideration of all of them in each case observed. Any bleeding after the menopause should be regarded as malignant in origin, until proved otherwise. Before the menopause, the indications are not so well defined but metrorrhagia is particularly significant.

Late menopause is emphasized by Crossen and Hobbs for its frequent occurrence preceding adenocarcinoma of the fundus. Of 56 cases of adenocarcinoma, 60 per cent of the patients passed the menopause at fifty or later, while only 15 per cent of the normal patients had a menopause as late as fifty. In their series, therefore, the incidence of late menopause in cases of adenocarcinoma of the fundus was about four times as high as in the normal cases. They were not able to obtain satisfactory statistics regarding the frequency of adenocarcinoma in late menopause. Nevertheless, they maintain that late menopause is a warning of a tendency to malignancy.

In reviewing 71 cases of adenocarcinoma of the body of the uterus, I found 40 (56 per cent) postmenopausal. The time elapsing between the menopause and the appearance of carcinoma varied from two to twenty-eight years with an average of thirteen years. Among the 40 postmenopausal carcinomas, the age of cessation of flow was earlier than fifty years in 23 cases or 57 per cent, and later than fifty years in 17 cases or 42 per cent. The average age of the menopause was 47.8 years. In this small group, the late occurrence of the menopause bears no significant relation to the incidence of carcinoma.

When curettement for diagnosis is indicated, two things should be emphasized. First, the procedure should be thorough in order not to miss an early lesion. Second, frozen sections of suspicious pieces of tissue are inadequate (Case 1). All of the material obtained should be collected and enough sections cut to insure inspection of all fragments of the curettings.

Improvement in the cure of carcinoma depends largely on the education of the laity. The physician cannot diagnose until the patient seeks his advice. Much has been accomplished by inducing women to report for periodic examinations. Interest has been stimulated in irregular bleeding. The graphic chart presented here is another means of increasing this interest and obtaining the cooperation of the patient. Furthermore, the chart improves the accuracy of the record and facilitates the interpretation of the bleeding.

#### SUMMARY

1. Bleeding is the most common symptom of adenocarcinoma of the body of the uterus, having been present in every one of our 71 cases.
2. Three case reports illustrate: the importance of irregular premenstrual bleeding; the significance of postmenopausal microscopic bleeding; and the association of adenocarcinoma and hyperplasia.

3. A chart is presented which stimulates the interest of the patient in bleeding, provides a graphic record, and aids in the interpretation of premenstrual bleeding.

4. Examination of a single fragment of tissue is inadequate. Sections from all the curettings should be studied.

5. Early diagnosis of adenocarcinoma of the body of the uterus depends upon the education of the laity to observe and report all irregularities of premenopausal bleeding and all postmenopausal bleeding.

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#### DISCUSSION

DR. NATHAN P. SEARS, SYRACUSE, N. Y.—In the pathologic laboratory at the Syracuse Memorial Hospital, all curettings are "put through," there being at times as many as ten or twelve blocks. I never feel confident in frozen sections of uterine curettings. For example, I was asked to make a frozen section of curettings on a patient about to have an interposition operation. I picked several pieces which when cut showed benign hyperplasia. Permanent sections showed a definite adenocarcinoma accompanying the hyperplasia. When these slides were examined twenty-four hours after operation, the patient had already had the interposition operation done.

The question of responsibility in the early recognition of cancer is pertinent. We have criticized the public for not appearing early. We must also criticize a good many members of our profession for not giving the patient a thorough and complete study when she does appear.

DR. W. A. SCOTT, TORONTO, CANADA.—Four cases have been encountered in a study of our carcinoma cases that emphasize a point not mentioned this morning. These patients had all been submitted to previous diagnostic curettage, one five years before, all of them more than one year before. We feel that in each this previous curettage was done very thoroughly. Subsequently each patient again developed irregular bleeding. Having been submitted to diagnostic curettage once and told that they did not have carcinoma, the symptoms were neglected with the onset of the next bleeding.

The members of this society know what is meant by thorough curettage, but the general practitioner sometimes does not. We know that carcinoma begins in the cornua of the uterus sometimes and that is the most difficult point from which to obtain a specimen. We are entirely against any such thing as aspiration for a diagnosis of fundal carcinoma. Although a frozen section may be of use, if it is positive, it is of very little use if it is negative, and we feel that all of the curettings should be examined in paraffin sections and done very carefully.

DR. WILLIAM H. WEIR, CLEVELAND, OHIO.—In cases of postmenopausal bleeding, it is very necessary to determine that the source of the bleeding is actually the uterus. One patient of mine had to be seen several times before it could be shown that the occasional hemorrhage came from a pinpoint opening in the prolapsed urethral mucosa, so small that it could not be seen unless the bleeding was actually



taking place. Another patient was convinced that a profuse hemorrhage came from the vagina when really it had come from the bladder, due to an essential hemorrhage of the kidney.

Diagnostic curettage with microscopic examination of the fragments may prove misleading. At the present time two such cases are in my wards. One had had a recent curettage by another surgeon and had been assured that the pathologic examination showed nothing dangerous. Her symptoms were so suggestive of corpus cancer that I removed her uterus which showed a well-marked malignancy of the fundus. In this case either the previous curetting had not been thorough or the interpretation of the sections had been faulty. In the other patient, uterine bleeding at the age of sixty-four years was the only symptom, and pelvic and abdominal examination showed nothing abnormal. Thorough curetting of the small atrophic uterus produced insufficient tissue for microscopic diagnosis. Continued bleeding led to an exploratory section which revealed a widespread abdominal carcinosis with secondary nodules in the liver and extensive involvement of the omentum. A small secondary growth involved one tube and mesosalpinx, and this was evidently the source of the bleeding into the uterus which showed no involvement itself. Exploratory operation would therefore seem justified in continued postmenopausal bleeding, even if pelvic examination is negative and a diagnostic curettage shows no certain malignancy.

DR. JAMES E. DAVIS, ANN ARBOR, MICH.—In cases where there is good reason to suspect malignancy a special request should be made to the pathologist to block all of the curettings and to cut sections from many different levels of the block. It is also important for the clinician to know that the curettings represent all of the uterine mucosa, otherwise he is not justified in judging that the pathologist has failed to make a positive diagnosis.

DR. VIRGIL S. COUNSELLER, ROCHESTER, MINN.—There were 150,000 patients who died of carcinoma in the registration area of the United States during 1935. Of this number, 82,000 were women and 50 per cent of the women died of carcinoma of the female generative tract. This disease is increasing at such a rate that we must give more consideration to the signs and symptoms of malignancy of the generative tract in women.

I have yet to see a carcinoma of the fundus in which there was not a failure or inactivity of the corpus luteum. I am certain that carcinoma of the fundus is definitely connected with the physiologic chemistry of the corpus luteum. If it occurs before the menopause it affects the woman who has a very irregular menstruation, which is the result of ovarian dysfunction.

No one has said whether the treatment should consist of roentgen therapy, radium therapy, or operation. Personally, I feel that inasmuch as 95 per cent of the carcinomas of the fundus grow very slowly and therefore are resistant to radium, and since carcinomata of the fundus respond especially well to surgical treatment, they should be treated by total hysterectomy.

DR. MORTIMER N. HYAMS, NEW YORK CITY.—I would like to ask the essayist if he has had any experience with uterosalpingography as an aid in the diagnosis of early carcinoma of the fundus of the uterus. It has been our custom at the New York Postgraduate Hospital to use the serial or fractional method of hysterography. This method consists essentially of successive injections of 2 c.c. each of a contrast medium with x-ray exposures after each injection until a total of 10 c.c. has been reached. The lumen of the uterine cavity and the Fallopian tubes is gradually outlined, and any defect in contour delineated step by step.

This method is particularly valuable in the diagnosis of obscure uterine conditions in women between thirty-five and forty-eight years of age, who present

no physical findings to account for irregular vaginal bleeding. The filling defect of the submucous uterine fibroid, the uterine polyp, the irregularity of the hypertrophic endometrium, the decreased density of the intramural fibroid and the craterlike formation in carcinoma of the fundus can usually be well defined.

DR. WILLARD R. COOKE, GALVESTON, TEXAS.—I should like to call attention to the relation between uterine polyps and carcinoma. Cervical polyps are of relatively little importance as the site of malignant change, and we have, in fact, only one specimen of this type. On the other hand, malignant change is relatively common in polyps arising from the endometrium.

The great danger in the pathologic diagnosis of absence of malignancy from fragments of such polyps lies in the fact that most of the material for biopsy is obtained from the periphery of the growth; whereas the primary development of malignancy usually occurs in the pedicle or the base of the polypoid mass. This is rarely obtained by ordinary biopsy technic.

DR. PRATT (closing).—The problem of adenocarcinoma of the fundus is altogether too broad to be considered as a whole. I wanted simply to emphasize bleeding as a sign which should always be explained, and the necessity of getting the cooperation of the physician and the patient.

Diagnosis in borderline cases of adenocarcinoma and hyperplasia may be very difficult, as Dr. Sears has pointed out. A doubtful case should be submitted to a jury of three which includes a pathologist and the operator.

Dr. Counsellor has taken a position in reference to the corpus luteum that can be partly substantiated. Inasmuch as a majority of adenocarcinomas of the fundus occur after the menopause, there would be natural failure of the corpus luteum as well as many other tissues.

Uterosalphingography is undoubtedly useful.

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## CLINICAL OBSERVATIONS ON THE TREATMENT OF PRIMARY CARCINOMATA OF THE CERVIX WITH 800 K.V. ROENTGEN RAYS\*

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THE treatment of carcinomata of the uterus with Roentgen rays in the region of 800 K.V. maximum was begun May 1, 1933. Though the five-year survival rate cannot as yet be given, a report on (1) the action of the 800 K.V. Roentgen rays on the carcinoma cells; (2) the reaction of the patient to the irradiation; (3) the changes produced in the skin and mucous membranes exposed to Roentgen rays; and (4) the three- and four-year survival rate of the primary carcinomas treated from May 1, 1933 to Dec. 1, 1934, would be of interest.

During this period, 873 patients with malignant diseases were admitted to the Radiation Institute. One hundred and seven cases were

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\*Read at the Fiftieth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, Hot Springs, Va., Sept. 20 to 22, 1937.

carcinomata of the uterus and 47 were primary and 60 recurrent cancers. Among the primary carcinomata, 10 were in the body and 37 in the cervix, and among the latter 6 were stump cancers, i.e., about 16 per cent. Thirteen of the primary cancers, namely all the corpus cancers and a few cervix carcinomata, were treated either with radium or with radium and Roentgen rays, and 34 primary cervix cancers were treated with 800 K.V. Roentgen rays without the addition of any other form of radiation. These 34 cases form the basis of this report and discussion.

#### THE ACTION OF 800 K.V. ROENTGEN RAYS ON CARCINOMA CELLS

The cellular changes produced in carcinomas depend to a great extent on the Roentgen ray dose applied at or in the tumor. The dose may be determined from measurements of the distribution of radiation

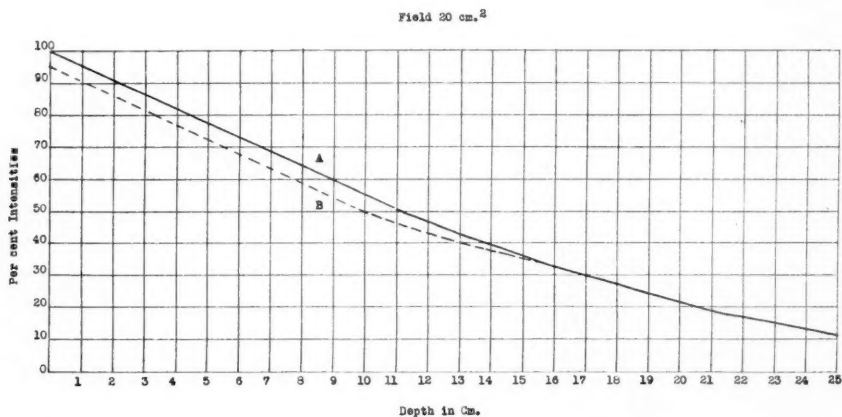


Fig. 1.—A, Absorption graph in center of field. B, Absorption graph 10 cm. lateral from center of field. One may say that the intensities at the periphery of the field are roughly 8 per cent lower than in the center until a depth of 15 cm. is reached when the intensities form a straight line.

intensities in a phantom. The latter was constructed of bakelite in such a way that the horizontal area was always 30 cm. square, but the vertical area could be changed to any desired anteroposterior diameter. In pelvic tumors the anteroposterior diameter was 22 cm. in more than 90 per cent of the female patients and 20 cm. or less in about 75 per cent of patients.

The graph shown in Fig. 1 was drawn from such measurements. Such a graph enables one to calculate the intensities attained in a pelvis with radiations applied through two or more ports of entry. For pelves having an anteroposterior diameter of 24 cm. or less two fields are used. Should the anteroposterior diameter be 25 cm. or more three or four fields are given. The axis of the beams is kept at an angle of 30° from the anteroposterior axis. The patient is maintained in this position by the use of rubber bags filled with sand.

Table I shows such a calculation for two fields.

The action of the Roentgen ray on the cellular components of the cervix is illustrated by the microscopic examination of tissues removed by biopsy. The first microphotograph, Fig. 2, was obtained from tissue before the commencement of treatment on July 1, 1937.

TABLE I. THE DISTRIBUTION OF CALCULATED INTENSITIES FROM 2 FIELDS EACH 20 SQ. CM. IN A PELVIS WITH AN ANTEROPOSTERIOR DIAMETER OF 20 CM.

DEPTH IN CM.			
0	114.3 93 + 21.3	121.3 100 + 21.3	114.3 93 + 21.3
5	106.6 72.5 + 34.1	116.0 70.55 + 36.5	106.6 72.5 + 34.1
10	94.6 47.3 + 47.3	110.0 54.50 + 54.50	94.6 47.3 + 47.3
15	106.6 34.1 + 72.5	116.0 36.3 + 79.50	106.6 34.1 + 72.5
20	114.3 21.3 + 93.0	121.3 21.3 + 100	114.3 21.3 + 93.0

*Pathologic Report.*—Sheets of tumor epithelial cells were separated by a stroma which was less abundant than the epithelium. The stroma consisted of fibroblasts, collagen, and capillaries, and its components were difficult to define due to massive infiltration by lymphocytes and plasma cells. Both the epithelium and stroma showed numerous eosinophiles. The epithelial cells were of moderate size with nuclei of moderate size. The latter were roughly oval or elliptical in the central portions of the sheets, more columnar and elongated near the stroma. In an occasional column of cells most of the nuclei were elongated. In structure, the nuclei were rather open, knots of chromatin and occasionally a nucleolus being prominently defined. The cell boundaries in areas were difficult to define. The cytoplasm was for the most part homogeneously basophilic. Mitoses averaged 1.7 per oil immersion field ( $\times 900$ ). (Range 4-0 in twenty fields.) Some of the mitoses were abnormal in form. In some areas the elements of the stroma were separated by clear spaces. Here the tumor cells were swollen, showing vacuolated cytoplasm and large vesicular nuclei. The cell and nuclear boundaries were at times poorly defined. No pearls or keratohyalin granules were noted.

*Diagnosis:* squamous cell carcinoma (Grade II).

The second microphotograph (Fig. 3) was obtained from a biopsy taken July 15, 1937 after five fraction treatments, each approximately 425 r. with backscatter, had been given. Therefore, the midpelvic dose attained was approximately 1125 r.

*Pathologic Report.*—There was moderate swelling of the tumor epithelial cells, the swelling predominating in their cytoplasm which for the most part was finely vacuolated. There was only moderate swelling of the nuclei. The latter were more vesicular and the chromatin masses and nucleoli were more pronounced than in the previous biopsy. There were numerous coarse vacuoles between the cells. The mitoses were fewer in number, average 0.4 per oil immersion field ( $\times 900$ ). (Range 2-0 in 20 fields.) Those seen were abnormal. One monaster showed clumps of chromatin near distal ends of spindle in addition to normal arrangement of chromosomes at its equator. There was swelling of the vascular endothelium and a looser structure to the stroma. Many of the polymorphonuclears were pyknotic; the structure of the plasma cells in the stroma was better defined and these cells

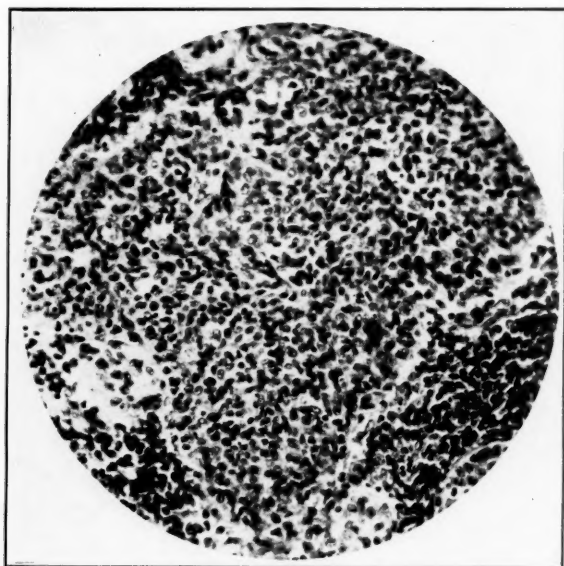


Fig. 2.—Squamous cell carcinoma (Grade II) before irradiation.

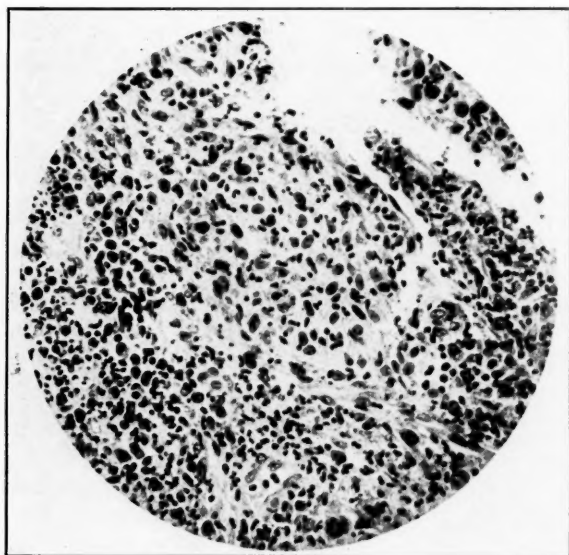


Fig. 3.—Tumor, illustrated in Fig. 2, after a tumor dose of about 1000 r. with backscatter had been given in the midpelvis. Swelling of cytoplasm and nuclei are predominating features. Magnification same as in Fig. 1.



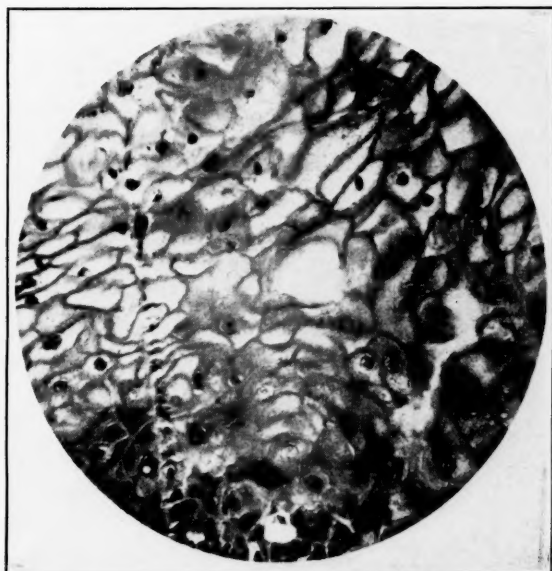


Fig. 4.—Radiation changes after a 2000 r. tumor dose in midpelvis to the now non-cancerous epithelium of cervix. Swelling and vacuolization of cells of prickle cell layer. Nuclei pyknotic or entirely absent. Same magnification.

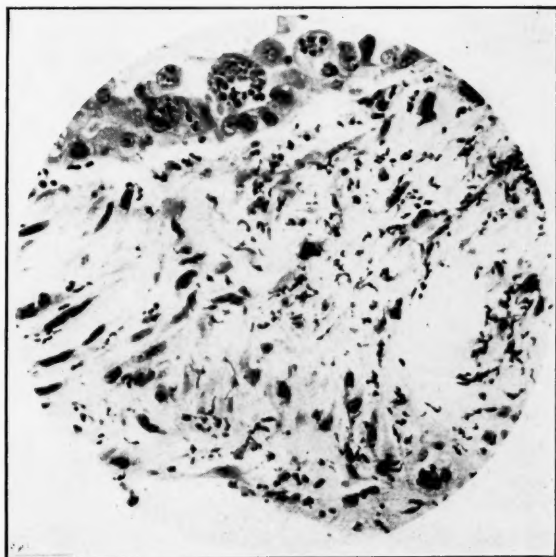


Fig. 5.—Radiation changes in noncancerous cervical epithelium after 3000 r. had been applied in midpelvis. Desquamation of superficial cells. Minute intraepithelial pustules. "Ballooning" of free end of one cell. Same magnification.

seemed slightly larger than in the previous section. A strip of noncornified stratified squamous epithelium appeared in this section. The cytoplasm of the cells in the Malpighian layer was slightly swollen. Many of the nuclei were pyknotic, a vacuole in apposition representing the original size of the nucleus. Prickles were well defined. In one area there was vesicle formation in the Malpighian layer.

Another five fraction treatment was given, the midpelvic Roentgen dose being approximately 2250 r. The biopsy report following this treatment was: No tumor was present. Specimen consisted of fragments of normal cervical tissue and blood clot.

On July 30, 1937 following the application of another five fraction treatments and a midpelvic Roentgen dose of about 3375 r., the examination of tissue showed the absence of all tumor tissue (see Figs. 4 and 5).

*Pathologic Report.*—No definite tumor was noted. The specimen consisted of mucus, masses of neutrophiles, and minute strips of stratified squamous epithelium. This epithelium was definitely not cancerous and was arranged in the ordinary layers.

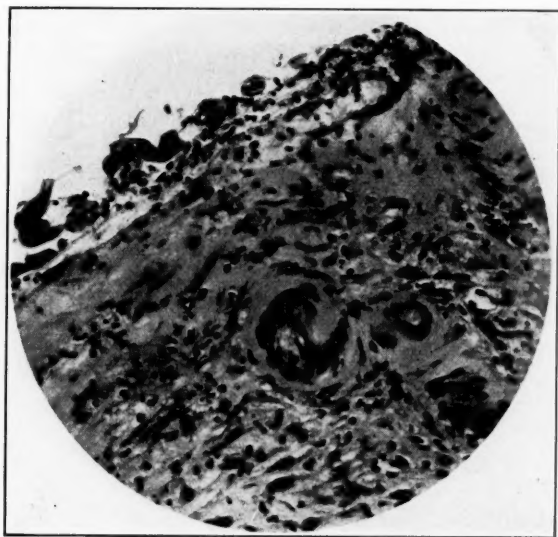


Fig. 6.—Radiation changes in noncancerous epithelium of cervix after a total of 4250 r. had been applied to midpelvis. Disappearance of most of epithelial cells with thin layer of fibrin and neutrophiles covering denuded area. Hyalinization of arteriolar walls. Proliferation of internal fibroblasts. Same magnification.

In this epithelium moderate swelling of the cytoplasm and nuclei with vacuoles in cells and between cells was noted. Prickles were still present. Hyaline globules represented remains of some of these cells. In portions of the epithelium, numerous large vacuoles filled with neutrophiles were noted. There were no mitoses (see Figs. 4 and 5).

A biopsy taken on Aug. 6, 1937 at the completion of the Roentgen treatment, and seen in Fig. 6, showed the changes accompanying a radiation epithelitis with pseudo-membrane formation. The midpelvic dose applied was about 4500 r. with backscatter. The recuperation rate of the normal tissues was about 15 per cent for each treatment following the third fraction and has not been subtracted.

*Pathologic Report.*—No tumor noted. Much of the tissue now consisted of the fibromuscular layer of the cervix. In places the epithelium was absent, fibrin and neutrophiles forming a thin strip over the denuded tissues. There was considerable hyalinization in the muscle here and an obliterating endarteritis. Where the

epithelium still persisted, the changes were similar to those described for biopsy 4 (Figs. 4 and 5) but rather more pronounced. In places the epithelial cells had lost their nuclei, staining pale blue, ballooning out from the basement membrane, the superficial layers of the epithelium being absent. Elsewhere there was considerable edema in the lower layers of the epithelium and in the subepithelial tissues. Neutrophilic infiltration here was noted both in the epithelium and in the tissues beneath it.

A biopsy of tissue removed Aug. 9, 1937 consisted of mucus, masses of neutrophils, occasional minute strips of a columnar epithelium, and small fragments of the hyalinized fibromuscular layer of the cervix. No tumor noted.

It is evident that the finding of completely degenerated carcinoma cells albeit a complete absence of tumor cells should not be interpreted as a cure but as an instance of the profound effect of the 800 K.V.

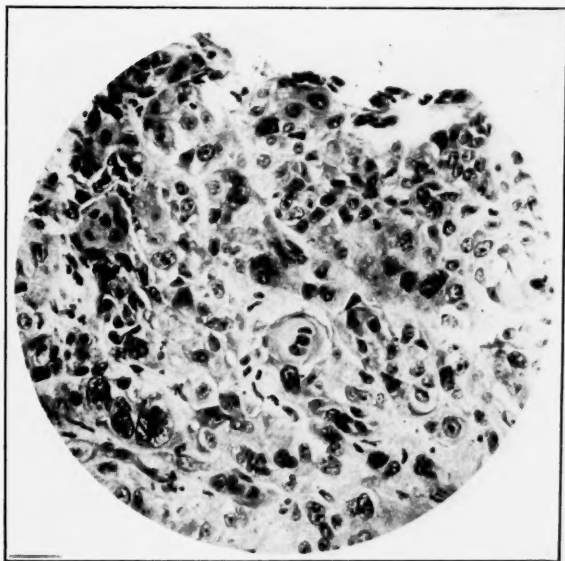


Fig. 7.—Epidermoid carcinoma before intensive irradiation. Squamous cells and pearls depicted. An inadequate radiation had been given elsewhere.

Roentgen rays in a deeply-seated cervix cancer. The steps in the degeneration in a serial number of biopsies may differ, but the slides show decided evidences of an almost generalized degeneration in the tumor mass. Such changes may be seen in simple inflammatory processes, but then they are never as generalized and abundant as in malignant tumors.

Photomicrographs of a radiated epidermoid carcinoma are also introduced here, because of the obviously marked histologic changes shown in them.

The first (see Fig. 7) represents the tumor before intensive radiation therapy. Figs. 8 and 9 are from the same tumor after intensive radiation. The marked swelling of the cytoplasm and nuclei of the tumor cells is well shown. Marked vacuolization of the cytoplasm, karyorrhexis, pyknosis, and disappearance of many

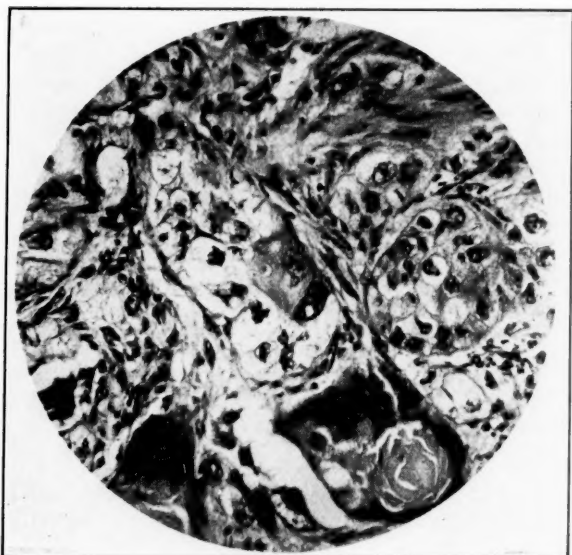


Fig. 8.—Tumor, illustrated in Fig. 7 after intensive irradiation. Magnification same as in Fig. 7. Marked swelling of tumor cells. Nuclei show pyknotoses, karyorrhexis and karyolysis. Degenerated pearls with foreign body giant cells in apposition.

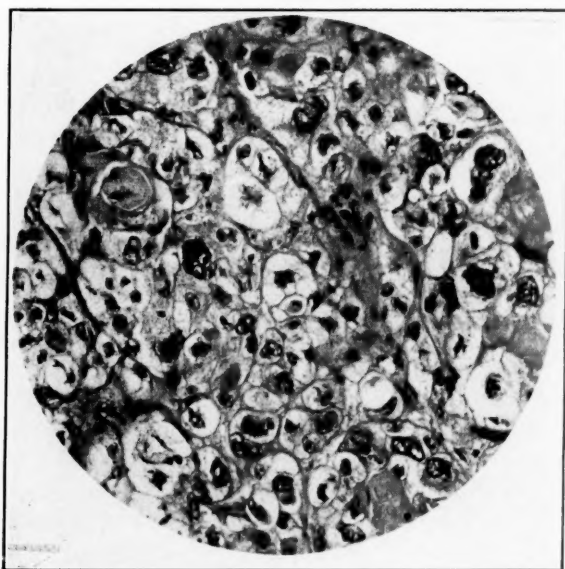


Fig. 9.—Microscopic field adjacent to area shown in Fig. 8. Similar features with exception that giant cells are lacking.

nuclei are also noted. In addition the epithelial pearls show degeneration changes. Their nuclei disappear and the keratinized remnants act as foreign bodies, foreign body giant cells arising in apposition to them (see Fig. 8). The magnification in all the photomicrographs in this paper is the same:  $\times 300$ .

These investigations will be continued and the authors hope to report the results at a future time.

Radiation reactions consist of: (1) the constitutional or general reactions termed radiation sickness; (2) the early and late reactions in the skin and accessible mucous membranes of the pelvic organs such as the urinary bladder, the vagina and the rectum lying within the radiation beams; (3) the action on the blood constituents chiefly the red and white blood corpuscles and the hemoglobin; (4) the latent results of treatment on the uterine cancer.

#### THE SYSTEMIC REACTIONS

The constitutional reactions were negligible with the technique of application of 800 K.V. Roentgen rays evolved in the institute. The patient with an anteroposterior diameter of 24 cm. or less was treated through two fields 15 cm. wide and 20 cm. long over the pubic and sacral regions. The upper limit is the promontory of the sacrum, the lower limit the vulva. Almost 85 per cent of the patients possessed an anteroposterior diameter of 22 cm. or less. The per cent of absorption at a depth of 11 cm. is approximately 50 per cent of that on the surface. This means that the application of a known dose of "r." through two fields produces exactly the same dose of "r." in the center of a pelvis with an anteroposterior diameter of 22 cm. The dose per field applied with 10 equally spaced fractions to each field within twenty-eight days is 4,225 r. Hence the midpelvic dose is 4,225 r. If the anteroposterior diameter is 20 cm., then the midpelvic dose is about 4,640 r., and if it is 18 cm. it is about 5,000 r.

The only untoward symptom was loss of appetite and some nausea which appeared about the time of the twelfth to fourteenth treatments, the same time when the changes in the skin and mucous membranes became marked. Other general constitutional reactions were not observed.

#### THE LOCAL REACTIONS IN THE SKIN AND MUCOUS MEMBRANES

The early reactions in the skin and mucous membranes exposed to the rays were erythema of the skin and mucosae appearing at the end of fourteen days when about 2,000 r. had been applied; a dry dermatitis and mucositis within twenty-one days, when about 3,000 r. had been given; and desquamation and wet dermatitis and pseudodiphtheritic mucositis at the end of twenty-eight days when about 4,000 to 4,500 r. had been applied. Epilation followed within another week. The entire process showed healing within three weeks but epilation



and tanning persisted for another one or two months. The final result is recovery *ad integrum* within about four to six months.

The radiation dermatitis causes burning and itching, and if bleb formation ensues, it causes secretion. The application of pure lard, Dodd's lotion, Edison ointment, and veracol\* ointment are used in sequence as the intensity of the changes increases.

Radiation mucositis of the urinary bladder causes frequent and burning urinations which respond to sodium or lithium benzoate. Radiation proctitis produces frequent and watery defecations. A bland diet, the administration of large doses of bismuth subnitrate, resublimed resorcin, sodium or zinc sulfocarbolate and finally pulverized extract of opium are recommended. The radiation vulvitis responds well to applications of zinc ointment.

Latent reactions in the skin or mucosae were not seen if the radiation doses were not increased or repeated. A few instances of intermittent attacks of diarrhea were observed. Persistency in a bland diet would prevent the diarrhea.

#### THE CHANGES IN THE BLOOD

The changes in the blood were studied by H. L. Schmitz. The erythrocyte count, hemoglobin percentage, leucocyte and differential counts have been determined routinely before the beginning of treatment and after the fifth, tenth, fourteenth, eighteenth, and twentieth treatments. Significant decreases in the erythrocyte count of 300,000 or more occurred only in ten of 60 cases, and were practically always associated with far-advanced malignant disease. In six instances there was a definite increase in the number of erythrocytes during the course of treatment. The remaining cases showed no significant changes.

Changes in the erythrocyte count were usually but not always accompanied by a corresponding change in the percentage of hemoglobin. In three cases, the hemoglobin percentage fell 10 to 15 points without any decrease in the erythrocyte count.

Changes in the leucocyte count occurred more frequently and were more pronounced than the changes in the erythrocyte count or hemoglobin. The leucocyte count dropped to or below 4,000 in 21 cases. In 19 of these cases, the leucopenia was very transient and the differential counts remained normal. Only two instances of stubborn leucopenia were observed, and these were both associated with multiple metastases to the bones.

#### RESULTS OF TREATMENT

The 34 primary cases of carcinoma of the uterus were arranged according to the anatomical extent of the growth, namely in four clinical Groups, as used in the Clinic since 1919. Clinical Group I

\*Veracol ointment is a 10 per cent mixture of the extract of aloe vera in a fatty base.

comprises the clearly localized beginning carcinoma with a normal mobility of the uterus. Clinical Group II means doubtful localization of the carcinoma within the confines of the cervix, but characterized by a decreased mobility of the uterus. Clinical Group III signifies invasion of one or both parametria but the entire mass is still movable. Clinical Group IV includes the fixed or metastasizing carcinoma. The pelvis is either frozen, or dissemination has taken place to either the bladder, the vagina or the rectum or to distant tissues and organs.

A comparison of the results of treatment was made for different periods in which a different technique was used as seen in Table II.

TABLE II. PRIMARY CARCINOMAS OF UTERUS

A. Treated with 140 K.V.P. R $\ddot{o}$ . and 3000 to 4000 mg. el. hr. Ra from May 1, 1920 to Dec. 31, 1921, showing results of treatment Dec. 31, 1924. Treatments in continuous sittings lasting one week.

*Spaced Roentgen Treatment*

CLINICAL GROUPS	I	II	III	IV	TOTAL
Number of patients	1	4	10	9	24
Number well	1	2	2	0	5
Percentage well	100.0	50.0	20.0	0.0	20.8

B. Treated with 200 K.V.P. R $\ddot{o}$ . and 4500 mg. el. hr. Ra from May 1, 1926 to Dec. 31, 1927, showing results of treatment Dec. 31, 1930. Treatments spaced and fractioned over three weeks.

*Spaced Roentgen and Radium Treatment*

CLINICAL GROUPS	I	II	III	IV	TOTAL
Number of patients	5	13	12	18	48
Number well	4	6	2	0	14
Percentage well	80.0	61.5	16.7	0.0	29.2

C. Treated with 800 K.V.P. R $\ddot{o}$ . from May 1, 1933 to Dec. 31, 1934, showing the results of treatment Sept. 30, 1937. Treatments given in 10 equal fractions during four weeks.

*Spaced Roentgen Treatment*

CLINICAL GROUPS	I	II	III	IV	TOTAL
Number of patients	2	2	13	17	34
Number well	2	2	9	4	17
Percentage well	100.0	100.0	61.5	23.5	50.0

From the results for the Clinical Groups and the periods, it may be stated that the increase in the three- and four-year good end results is due to a marked increase in the percentage of arrested cases in Clinical Groups III and IV. The explanation of this observation may be the more homogeneous distribution of radiation intensities throughout the pelvis obtained by 800 K.V. maximum Roentgen rays in comparison to those by 140 and 200 K.V. maximum Roentgen rays and gamma rays of radium. The microscopic examination of tissues at stated intervals furnishes evidences of the intense influence of the 800 K.V. Roentgen rays on the carcinoma cells. Studies made with

200 K.V. Roentgen and gamma rays of radium show that the changes in the carcinoma cells occur at much later periods and are never complete, i.e.; they do not show total absence of cancer cells when 200 K.V. Roentgen rays were used.

#### CONCLUSIONS

A report has been made on the action of 800 K.V. Roentgen rays on (1) the carcinoma cells; (2) the constitution; (3) the skin and mucosae; and (4) the blood constituents.

The changes in the carcinoma cells, i.e., practically complete degeneration and absorption, may occur as early as the midperiod of treatment.

Radiation sickness is hardly ever seen. If it occurs it usually coincides with the time of reactions in the tissues lying within the radiation beams.

The changes in the count of the blood cells and the percentage of hemoglobin are mild and if occurring they are of a transient nature.

The reactions in the skin and mucous membranes lying within the radiation beams are very marked during the last week of the four-week treatment period, but they usually subside very rapidly and completely within four to eight weeks. The skin recovers completely within three to six months.

The three- to four-year arrests of the growth subjectively and anatomically in 34 primary carcinomas was 50 per cent.

#### DISCUSSION

DR. JAMES E. DAVIS, ANN ARBOR, MICH.—It is recognized that there are three types of cells in carcinomata, the unripe, the midripe, and the ripe. It is not to be understood that the term "ripe," used in the third grouping, refers to normal cells. There is no such thing as a matured carcinoma cell. In all three groups varying percentages of unripe cells are present. Irradiation therapy will have the greatest effect upon the tissue containing the largest majority of unripe cells.

Swelling of the nucleus was noted as one of the results of these treatments, also changes in the chromosomes. It is appropriate to remember in this connection that there are twenty-four pairs of chromosomes in each cell of the human organism and their arrangement so far as is known is in parallel lines. The different types of genes have positions opposite one another. Any disarrangement of this normal placement will interfere with the behavior of the life of the cell or cells.

The mitotic activity of the cells was also discussed. Mitosis will occur in a carcinoma in direct proportion to the size of the cells or in other words, when a certain size is attained division will take place. There is thus a normal relationship between the content of the cell and its circumferential measurement. Disturbance of this relationship is followed by cell division. The use of radium reduces the size of the cells and the number of mitotic changes prevailing.

The presence of pyknotic nuclei denotes that the cells are dead or dying in a great majority of instances. Ten days after treatment it was noted in some sections that no carcinomatous tissue remained. One must face the danger, however, that every worker in this field has recognized, namely, that the penetration of the

x-ray or radium varies with prevailing conditions, and the effect upon cells may be reduced as much as 50 per cent for those farthest away from the surface treated.

Another significant factor in irradiation therapy is evident in the tissue reactions. Ordinarily the blood vessel walls become thickened and their lumina will be narrowed. In this group of cases irradiation therapy will be favorable, but in cases where the blood vessels show no reactive ability, irradiation is likely to fail.

DR. JEO VINCENT MEIGS, BOSTON, MASS.—In the *Annals of Surgery* for October is a paper presented before the American Surgical Association in New York in June, showing the results obtained in the Massachusetts Department of Public Health, Pondville Hospital. The results of these cases treated by large doses of Roentgen ray by the 200 K.V. machine plus radium are better than any previous group that has come under my care. The charts of the results are well worth studying.

Our charts show a three-year follow-up to be sufficient to judge a method of treatment, for the deaths after this date follow a perfectly definite curve in all series. Therefore, I am inclined to believe that Dr. Schmitz' cases are going to be almost as good as they are now at the end of five years.

Certainly it is obvious to me that Roentgen ray and radium are better than radium alone. Roentgen ray may supplant even radium.

DR. HENRY SCHMITZ, CHICAGO, ILL.—Without the work of Drs. J. Sheehan and Herbert Schmitz this report could not have been made.

I thank Drs. Davis and Meigs for their kind discussions. The advantage of the x-ray treatment with 800 K.V. lies in the ideal and homogeneous distribution of the radiation intensities throughout the tumor bearing area and the possibility of using much higher radiation doses than with any other kind or quality of rays.

The observations of Dr. Meigs are very valuable. They will enable us to evaluate the advantages of radiation treatment much earlier than the customary five-year periods, and hence predict the correctness of an improved treatment much earlier than usual.

The histologic examinations will be continued. It is evident that the case on the action of x-rays reported today may not be the rule. However, such investigations are valuable to indicate the method of treatment and the radiation doses to be applied to arrest the cancer.

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## THE DIAGNOSIS AND MANAGEMENT OF DIVERTICULOSIS AND DIVERTICULITIS OF THE PELVIC COLON IN WOMEN\*

FREDERICK S. WETHERELL, M.D., SYRACUSE, N. Y.

**P**ELVIC inflammatory disease, either acute or chronic, is not necessarily the result of infections of the female generative tract. The pelvic colon may be the seat of the trouble; yet it is rarely recognized as such until symptoms of obstruction supervene.

Diverticulosis of the colon is not uncommon in the female, and it is important to keep in mind that acute and chronic inflammation of diverticula may resemble in all of their manifestations what we speak of as pelvic inflammatory disease.

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\*Read at the Fiftieth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons at Hot Springs, Va., Sept. 20 to 22, 1937.

Pain, tenderness, urinary frequency, hip and backache, fever, bowel dysfunction, lower abdominal distress, and low grade of fever are common to both conditions.

The important difference, however, is that in the acute stage of diverticulitis the outstanding symptom of low intestinal obstruction enters the picture, viz., intermittent cramps, the sign of defeated attempts of the bowel to complete a peristaltic wave. As the obstruction progresses, there is of course, a distention of the abdomen within a much shorter time than is the case in acute adnexal disease.

Bimanual pelvic examination elicits the presence of a mass which may be in the right as well as in the left side. There may be pain on movement of the uterus; the latter due to inflammation by contiguity. The process, by extension, may also involve the bladder wall and is the reason for the urinary symptoms. Repeated attacks, when the bladder wall is involved, may end in perforation of that viscus.

An early report of a perforated bladder, the result of diverticulitis, may be found in the publication, "Nine Commentaries Upon Fevers and Two Epistles Concerning Smallpox," addressed to Dr. Mead by, "the late brilliant Dr. John Freind."<sup>1</sup> It was printed in London in 1730. Thus two hundred and seven years ago Freind described in detail, and with excellent follow-up notes, the case of "a very ingenious and studious gentleman who was remarkable for his singular memory. . . ." who was "seized with a pain, flatus, and a sort of convulsion in his bowels." He then, "passed pus and gas per urethram for three months," the author stating that "such a flatus often broke forth with his urine, that the patient seemed to break wind backwards." Autopsy showed an inflamed mass of the colon with a hole into the bladder, "the size of a goose quill."

I believe that this is perhaps the earliest report in English medical literature of this condition, and when one considers the time which has elapsed since then, it does seem strange that a mention of diverticulitis still brings to the mind of many physicians an inflamed Meckel's diverticulum.

The other end-results of a continuation of the disease, with repeated acute exacerbations, may be either perforation of the gut wall, or complete obstruction due to the increasing fibrosis which follows each episode.

The pelvic colon may have diverticula in its terminal portion as well as its beginning. One of these small pockets of peritoneum-covered mucosa, with its bottle-neck-opening into the gut may, because of the irritation of contained infected feces, become adherent to structures in the right side of the pelvis as readily as in the left side. This explains why an attack of diverticulitis may on one occasion cause pain and cramps in the left side of the lower abdomen and pelvis, and at another time, an equally distinct group of symptoms on the right side. Keeping this in mind should clear up some of the confusion which has been continued through the literature in which one finds repeated the statement, that diverticulitis is to be thought of as a left-sided appendicitis.



Most authors speak of the difficulty of palpating a mass, but if one familiarizes oneself with the feel of the normal colon, by abdominal palpation, it is not difficult to notice a change in size when this viscus is distended, or, as occurs in diverticulitis, distended and hardened by the inflammatory reaction surrounding it. This palpation is best done by using one hand for sensation and the other, superimposed upon it, for purposes of pressure.

#### INCIDENCE

Last year, Roscoe R. Graham of Toronto,<sup>2</sup> made a study of the incidence of diverticulitis in 44 personally observed cases. He found that "such diverticula are present without symptoms or any clinical evidence of their presence in approximately 5 per cent of persons subjected to a routine x-ray examination of the colon for any cause. Of this 5 per cent, approximately 12 to 15 per cent develop diverticulitis. To translate this into the incidence occurring in a family practice, we grant that 1,000 patients constitute a practice; we grant that 250 will be over forty years of age; 12 of these will have diverticulosis, and at least 1 will have diverticulitis. . . . When one considers that in a family practice there is on the average only one case of duodenal ulcer under active treatment, we realize that from the general practitioner's viewpoint, his problem with sigmoid diverticulitis should be as great as with duodenal ulcer, and yet the interest and discussion of these two disease processes show a great disparity."

This study, I am certain, is correct in its conclusions. Furthermore, one finds in the literature of the past three years figures which indicate that women make up from 30 to 45 per cent of the number of cases of diverticulosis and diverticulitis. It is my feeling that an alertness on our part will uncover many more cases of both the chronic and subacute types of the disease in women who come for treatment because of low abdominal or pelvic distress.

#### MANAGEMENT OF THE ACUTE CONDITION

As Thomas E. Jones, of Cleveland,<sup>3</sup> said before the American Proctologic Society at Kansas City, Missouri, in May of 1936, "It is easy to tell the other fellow what to do with his cases, but when it comes to advise your own, it is not so easy." Nevertheless, we have three fundamental conditions or complications with which to deal in the acute exacerbation of a diverticulosis. They are: (1) A low obstruction of the colon. (2) Perforation with infection and abscess formation behind the sigmoid flexure of the colon, or, rarely, into the peritoneal cavity. (3) Inflammation of the bladder wall by contiguity which if long continued may end in perforation and drainage into the bladder.

In dealing with the first of these conditions, we must keep foremost in our minds the fact that an obstruction in the terminal colon, sometimes quite close to the rectum, is not of the same serious import that a higher obstruction is, particularly one in the small intestine. As a rule, the obstruction is preceded, for several days, by a gradually increasing partial-obstruction of the lumen, with cramps, followed by the expulsion of gas and either solid or liquid feces. With this picture in mind, it can be seen that complete bed rest, preferably in a hospital, with a liquid

diet, or even entirely parenteral fluids, is imperative. This regime, even though it is found necessary to continue it for one or two weeks, will in the majority of cases, in a first or second attack, result in a recession of the inflammatory condition and re-establishment of a lumen sufficiently large to permit passage of fecal material. Such treatment will even allow the subsidence of an abscess, and of the markedly inflamed colonic wall.

If, however, nonsubsidence of the abscess is indicated by the usual examination and laboratory findings, something further must be done. Here the pelvic surgeon with his knowledge of pelvic abscesses, due to other conditions, will without doubt advise simple drainage. Whether this drainage is to be by the abdominal route or by a lateral extraperitoneal approach, or as suggested and used by Ralph Weible,<sup>4</sup> drainage through the anterior wall of the rectum, will of course depend on the location of the mass and the experience of the surgeon. In these cases however, vaginal drainage is contraindicated because of the possibility of fecal fistulas following such drainage. The rectal approach seems to be the most logical one, providing, of course, that the abscess is in a position to be reached.

The next order of procedure is aimed at establishment of abscess drainage and decompression of the bowel. When colostomy is contemplated, the fundamentals of good abdominal surgery indicate that the farther away from the acute inflammatory condition, the better for the patient. Therefore, a cecostomy of the type which will insure nonclosure of the stoma is the procedure of choice. I would here reiterate, that complete low obstruction may be tolerated for ten days to two weeks and that these patients quiet down as a rule, and not as an exception. Therefore, any form of colostomy is to be put off as long as possible.

Involvement of the bladder wall with its coincident irritation and urinary dysfunction, and perforation into that viscus are problems, the solution of which need not be detailed to those familiar with pelvic surgery. Suffice it to say that in the event of such perforation, it would without question be advisable to decompress the bowel by cecostomy, evacuate abscesses by drainage, and wait for a complete quiescence of the disease before attempts at repair are instituted.

The literature of the past two years indicates that the error of attempting a colostomy just proximal to the inflamed area at the same stage in which drainage is done, is still being made. One such error occurred in a case which I saw in consultation with the surgical department of one of our hospitals. I was called in to determine the possibility of the presence of a pathologic condition in the pelvis.

A diagnosis of acute diverticulitis with abscess was made and drainage advised. The patient was operated upon by a member of the surgical division and a colostomy done, with the drainage operation. The woman survived forty-eight hours.

The management of this condition will parallel that of acute salpingitis which, in the early days, was accompanied by a high death rate because of ill-advised abdominal sections. These patients are too sick for any extensive procedure, and for that reason, drainage alone should be resorted to, for, in the event that this does not suffice, no harm has been done, whereas an added colostomy (except perhaps cecostomy) adds from 50 to 75 per cent to the mortality rate.

#### MANAGEMENT

*Acute Stage.*—It must be remembered that the obstruction is low, sometimes quite close to the rectum, and that such a location permits of long bowel stasis without imminent danger. The patient should be either on parenteral or liquid nourishment. A few days to two weeks may be long enough for the acute process to subside following simple drainage of the abscess, and thus a patent lumen becomes established through the mass. This has been my actual repeated experience and is the foundation for my belief that drainage alone should be resorted to as a relieving measure for abscess, and that even drainage is to be avoided until the general signs of abscess, and lack of abatement of the obstruction, indicate that something *must* be done. Bowel function may be established without surgical interference even after a week to ten days of complete low obstruction, provided of course that there is evidence of subsidence of an acute inflammatory process.

If colostomy must be resorted to, it is perhaps best that a permanent type of opening be made with invagination and closure of the distal segment. Present-day management of such a stoma has eliminated the old bugbear of colostomy. However, the fact that proper management of the diverticulosis following an acute attack offers the patient a comparatively comfortable and long life, argues for the utmost in conservatism during an acute attack.

Bowel resection, when the disease is low in the pelvic colon, is attended by such technical difficulties, and such high mortality rate, that it is fair to say that it should never be attempted.

*Quiescent Stage.*—Once an acute attack, always the likelihood of another. It is sufficient to say that a relatively residue free diet with elimination of gas forming starches (particularly potato), and condiments, plus the avoidance of emotional disturbances, which initiate an increased intestinal peristalsis, and heavy lifting which results in increased intra-abdominal pressure, are the general rules which the patient must follow if the danger of acute exacerbation is to be avoided.

*Subacute Stage.*—This condition has been almost entirely overlooked by writers. A low-grade inflammatory process may continue over a period of weeks or even months and is the cause of intermittent low abdominal and pelvic distress. It is during this stage of the disease that women often seek the advice of the physician. The symptoms are those attendant upon any pelvic inflammation plus evidences of bowel disturbance. There is a general low abdominal soreness, and to be particularly noticed is the distress which accompanies walking, or being jarred while in a sitting position. The latter, of course, occurs during automobile rides or train journeys. The patient feels as if she were carrying around a sore mass which must be treated with a great deal of gentleness. She bends forward when she walks and is likely to support her abdomen with both hands to relieve the feeling of pressure and to save jarring. Bearing down during defecation is a painful procedure and the same holds true during urination.

This train of symptoms should make one suspicious of the existence of the condition, and it is at this time when examination by x-ray is indicated. Such

examination, and it should be done by the contrast method, in which the lower colon is inflated with air, following the expulsion of a barium enema, will reveal in the majority of cases the existence of the disease.

X-ray examination is definitely contraindicated during the acute stage.

Having discovered the presence of a diverticulosis, it is then our duty to make clear to the patient the future which confronts her unless the greatest care in following a dietary regime is exercised, and the other routine mentioned elsewhere, is meticulously carried out. So often do acute attacks occur following mild upper respiratory infections, and subsequent to overtiring activities, especially heavy lifting, that it is well to impress such dangers upon the patient. There is nearly always a tendency to obesity in these individuals and for that reason, the diet, in addition to being relatively "residue-free," should also be regulated in regard to keeping the weight down.

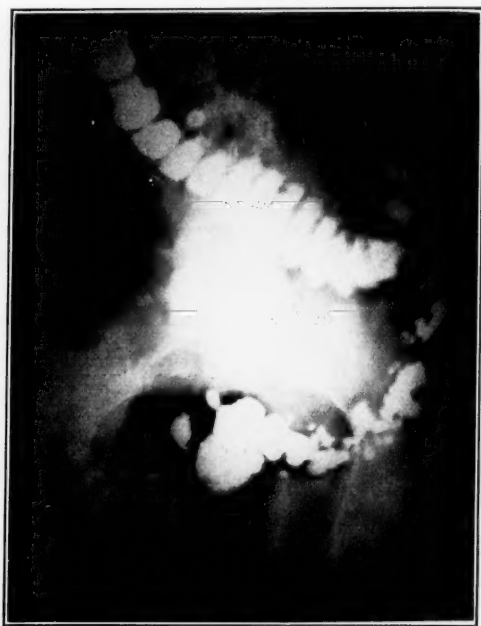


Fig. 1.—Sigmoid colon shows numerous diverticula, one particularly large one extending to the right side of the pelvis. (Mrs. R. Aged 58 years.)

The discovery of the presence of the disease by a careful inquiry into the patient's history regarding episodes of bowel dysfunction accompanied by low abdominal and pelvic distress, is, if anything, more important than management of the acute stage. Only by so doing will we be able to warn of the dangers and so help these individuals to avoid the acute attacks which are always imminent. Both gynecologists and abdominal surgeons have here a much neglected field.

Two short case histories illustrate this point:

Mrs. R., fifty-eight years of age, was operated upon for relief of a descensus uteri April 25, 1936. In her history appeared the following: Bowels always fairly regular with some tendency to constipation. About four years ago, the patient was taken with pain in the left lower quadrant of the abdomen. This pain was fairly severe and lasted several days. It was cramp-like in character and was accompanied with nausea and vomiting, and diarrhea. Since that time she has had three other at-

tacks, two years ago, one year ago, and about six weeks ago. During the last attack there was pain but no diarrhea, nausea, or vomiting. She has never had any bright red blood passed from rectum or had any tarry stools. Pain was quite severe and there was some bloating of the lower abdomen. For several days soreness followed the pain. These were the only changes in bowel habit, and when well there had been no change in the type of stool. At times she notices some mucus.

Because of these findings an x-ray examination was ordered and the diagnosis of diverticulosis was confirmed (Fig. 1). This woman has not had any attacks since operation and is carefully following regime.

Mrs. C., aged sixty-four. This woman's history disclosed the fact that she had had a feeling of fullness in the lower abdomen and often became distended with gas. She felt as if there was "a place where gas had difficulty in passing, low down." After the gas passed this point and entered the rectum, she was relieved. A diagnosis of diverticulosis was confirmed by x-ray studies. The picture is so much like that in Fig. 1 that it is not reproduced here.

Her operation, done on Feb. 25, 1936, was also one for descensus uteri. She has had no attacks since following a proper regime of bowel management.

#### SUMMARY

Diverticulitis of the pelvic colon in women has many of the earmarks of so-called pelvic inflammatory disease.

Obstructive symptoms, during an acute attack, plus a history of previous bowel disturbances accompanied by cramps, are the important differential diagnostic points.

Management of the acute stage should lean toward conservatism. Operative interference is not as essential in low colonic obstruction as elsewhere in the intestinal tract.

Careful inquiry into the history of bowel disturbances which are accompanied by low abdominal and pelvic distress, checked by x-ray examination, points the way to prevention of acute attacks. A "residue-free" diet, and a gentle mode of living are the essentials of prophylaxis.

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713 EAST GENESEE STREET

#### DISCUSSION

DR. E. A. VANDER VEER, ALBANY, N. Y.—It was not so many years ago that we grouped practically all the pathology in the female pelvis due to infection under the generic term pelvic inflammatory disease, and considered that 80 per cent of the cases were due to a specific infection. Our present knowledge of the pathology of the female pelvis shows us that that supposition was wrong and that many factors enter into the causation of the pelvic inflammatory disease. As I look back now over some of my pelvic cases in which the apparent cause of the inflammation was obscure, I have no doubt that the pathology was caused by diverticulitis which I failed to recognize.



DR. VIRGIL S. COUNSELLER, ROCHESTER, MINN.—It has been my experience twice this year to subject the pelvis to surgical exploration for what I thought was an ovarian tumor, but what proved to be diverticulitis which had become adherent to the left adnexa. Why is such a mistake made? First of all, in a pelvis in which diverticulitis is present the inflammatory process is as a rule higher up than it is when adnexal disease alone is present. Usually, the mass is more or less mobile. The best diagnostic procedure is to place one finger in the vagina and the other in the rectum and determine if you can move the rectal wall separately from the adnexal mass. Suppose the abdomen has been opened and this condition has been encountered, what should one do? If the mass is only very lightly attached to the adnexa and can be separated easily, it is best to mobilize the mass, wrap the lesion with the omentum and bring it over to the midline of the pelvis. The abdomen should then be closed as it is after an exploratory laparotomy and conservative medical treatment should be employed.

If the lesion is extensive and a tuboovarian inflammation is present, should one proceed with the primary radical operation? I do not think this is advisable as the risk is too great. Therefore, one should divert the fecal stream by a colonic stoma in the descending colon well above the lesion and should forget about it for two or three months and decide later what should be done. Perhaps nature will take care of the whole condition and one will need to do nothing else but close the colonic stoma.

One must always keep in mind that diverticulitis is an important disease, and in operating in the pelvis of women, it is well to examine the sigmoid colon and see if there are any diverticuli, because it has been my experience to find some which have exudate around them and which are totally unrelated to any other pelvic condition. If one fails to recognize them and they are injured, the patient is liable to die of peritonitis, as often happens in cases of infected carcinoma or ulcerative colitis. By merely touching the areas that are inflamed, the organisms go right through the intestinal wall and produce fatal peritonitis.

I was very much interested in Dr. Wetherell's findings because they coincide almost identically with those of my colleague, Dr. P. W. Brown. It has been shown that 5 or 6 per cent of all people have diverticulosis. The ratio of diverticulitis to diverticulosis is 1:6 or 8. Operation was done in 68 per cent of the cases. The situation of the lesion was usually in the sigmoid colon. Proctoscopic examination will reveal the extent of healthy intestine distal to the lesion. If it is necessary to do a resection, one must know what healthy bowel is available for anastomosis. Bleeding from diverticulitis is not common. If there is bleeding, carcinoma must be suspected because diverticulitis is not a mucosal lesion.

Dr. Wetherell spoke of obstruction. These patients do have obstruction, but we found in this group that the obstruction was not the outstanding feature. Patients usually referred to pain and had fever and leucocytosis. In 18 cases there was a fistula into the bladder; in 12 of the 18 cases obstructive phenomena were not present. There is no particular relationship between diverticulitis and carcinoma.

Of the 99 patients that were subjected to operation, 46 were benefited, 16 died immediately or within a few months after operation, and 19 continued to have trouble. We have tried medical treatment at the clinic but in most of these cases the complications demanded operation either because of abscess or perforation. The patients who do not have complications are treated medically and get along well.

With regard to medical treatment there are one or two points to be emphasized. Heat has been used within the last year where abscess has developed. We found that by introducing heat into the rectum, either by the Elliott principle, by two-way irrigation of the rectum with hot oil or hot water, or by diathermy, after about ten or

twelve treatments the mass will be tremendously reduced. If operation is then considered advisable, it can be done with less risk and better chance for successful result.

DR. W. WAYNE BABCOCK, PHILADELPHIA, PA.—One doctor, who had suffered from the disease for about twenty years, told me that he was relatively comfortable on what he termed a "cow" diet. Instead of foods with seeds and fine cellulose particles, he partook freely of leafy vegetables with long fibers, which held the fecal masses together so that they slid over the openings of the diverticuli and at the same time overcame the tendency to constipation. Many of these patients seem to be relieved to a degree by bismuth or barium, carried to the pouches by enemas.

A chronic type of perforation often occurs without an acute attack. While apparently in his usual health, the patient may suddenly note the presence of gas and fecal matter mixed with the urine, or a mass developing in the left groin, or material from the ileum mixed with feces. The colon infection from a fistula into the bladder is serious, and if it continues for any considerable time, it may lead to a permanent or even fatal infection of the urinary tract.

As for colostomy, the simplest type is to pull the appendix and the mesoappendix through a muscle splitting incision one or two inches long. Dressings are applied, the tip of the appendix then cut off and a small catheter introduced. No sutures are required. Daily a larger catheter is substituted and at the end of a week we have had a rectal tube size 27 or 28 cm. into the rectum. But the appendix in elderly persons is often atrophic and too small, when the side of the cecum is utilized. The mass of diseased bowel from a diverticulitis can usually be removed with greatest safety by a Mikulicz type of operation.

DR. JAMES W. KENNEDY, PHILADELPHIA, PA.—I would like to ask Dr. Wetherell about the right-sided pain. How many of the patients had pain in the sigmoid region?

DR. WETHERELL (closing).—The anatomic layout of the pelvic colon takes it to the right side of the pelvis and then back in the form of an "S." This is the reason for the term, sigmoid. If our diagrams of the pelvic colon were made to depict this "S," it might clear up much of the confusion concerning right-sided pain due to pelvic colonic disease.

These patients have a definite history which of course must be obtained. They are sometimes severely ill for a few days and then suddenly feel much better. The cramps during the attack are severe enough to necessitate confinement to the house. Every time the bowel begins to contract and by its peristaltic action tries to force something through the inflamed, narrowed lumen, there is a cramp. Having had such an attack for several days, and then suddenly having the pain quiet down, makes the patient anxious to forget that upset. The patient may not tell about these attacks unless careful inquiry is made into the history of bowel disturbances.

I have tried to stress the point that you can wait with a low obstruction. Bowel movement is not necessary for ten days or two weeks.

So far as doing a Mikulicz operation on a rectosigmoid mass, particularly where there is a diverticulitis, I must disagree with Dr. Babcock. It has a high mortality.

A STUDY OF CERTAIN DIETARY FACTORS OF POSSIBLE  
ETIOLOGIC SIGNIFICANCE IN TOXEMIAS OF PREGNANCY\*

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DURING the past few years there has been a healthy "opening up" of the so-called toxemia of late pregnancy. In a most comprehensive paper Kellogg<sup>1</sup> has summarized the different thoughts. The suggestion again has been made that the term "toxemia" be discarded; since no one has ever demonstrated a toxin, many have favored this change. However, Dr. Lee thought this term should be retained until the correct term is forthcoming. The classification is being altered and new factors are being investigated and old ones reevaluated. Peters<sup>2</sup> and others have recalled the association of urinary infection. Irving and others<sup>3</sup> studied and evaluated the vascular phenomena.

In order to add to the sum total of information regarding these conditions without adding to the confusion, all pertinent data should be recorded and be subjected to comparison and to checking. The only single factor that is consistent is the state of pregnancy. The variables of severity, mortality, and other manifestations in different localities and years have been recorded. We have not been able to report such favorable figures as Rucker,<sup>4</sup> Siebel,<sup>5</sup> and Colvin<sup>6</sup> in neighboring states. We have found urinary infection and essential hypertension in the private patient group more often than in the lower stratum where we have found eclampsia. That eclampsia and puerperal albuminuria have been the most frequent and the most severe obstetric complications in North Carolina is best shown by the tables which are given later.

Bland<sup>7</sup> in analyzing various reports quoted an incidence of toxemia of pregnancy of 13.5 per cent as the cause of death in 153,598 maternal deaths in this country from 1924 to 1928. In Great Britain the incidence from this cause was 19.8 in 1596 maternal deaths.

In the final report of the Commission on Medical Education the cause of death from toxemia was 27 per cent. This was a study of the years 1926 to 1928 when the maternal death rate was 67 per 10,000 live births. In the maternal mortality in 15 states<sup>8</sup> 7,537 maternal deaths were studied and the rate was 64 deaths per 10,000

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live births. Puerperal albuminuria and convulsions were the cause of death of 1,900 women or 26 per cent. The majority of these patients were from the rural districts and the incidence among the colored race was relatively higher. The Maternal Mortality Commission in New York City<sup>9</sup> reviewed the cause of death in 2,041 patients and found toxemia as the cause in 230 patients or 14.8 per cent, and this was greatest in the fifteen- to nineteen-year group (24.1 per cent). The maternal mortality in the Philadelphia<sup>10</sup> report listed toxemia as the third largest cause of death. There were 7,700 deaths and 114 were due to puerperal albuminuria and eclampsia (15.8 per cent). In North Carolina puerperal albuminuria and eclampsia have accounted for 25 to 35 per cent of the maternal deaths.

The population of North Carolina in 1930 was 3,417,000, of which 35 per cent was colored and 70 per cent was rural. The live birth rate was about 25 per 1,000 population or about 75,000 a year. The stillbirth rate was 40 per 1,000 live births. The general death rate was about 33,000 to 34,000 a year.

TABLE I

	NO. MATERNAL DEATHS	NO. BIRTHS	RATE	ALBUMINURIA AND ECLAMPSIA	
1932	555	77,880	7.1	185	33.3%
1933	535	75,322	7.1	175	32.7%
1934	605	79,556	7.6	181	29.9%
1935	554	79,596	7.0	147	26.5%
1936*	497	76,869	6.5	135	29.7%
	2,746	389,223	7.1		

\*Provisional.

The local problem is graphically detailed by Bradford<sup>11</sup> who is quoted: "It is my belief that in the three states of North Carolina, South Carolina, and Virginia the relative importance of the contributing cause of maternal mortality cannot be compared with metropolitan centers for the factor of lack of proper prenatal care is a greater problem in our rural communities than in the urban areas." In 1932 in the State of North Carolina 26,077 women (33 per cent of birth registrations) were delivered by midwives. In New York City 8.5 per cent of pregnant women are delivered by midwives. An interesting table (Table II) shows the contrast.

The comparison with a like number of patients in another state is recorded.

TABLE II

12,041 DEATHS. NEW YORK CITY. (COMMONWEALTH FUND)		334 DEATHS. NORTH CAROLINA. (STATE BOARD HEALTH)	
17.5%	Abortion	11%	
25.0%	Sepsis	15%	
9.7%	Hemorrhage	10%	
12.0%	Toxemia	41%	

Hamilton<sup>12</sup> has classified the maternal deaths as related to the time of pregnancy that the pregnant woman first consulted a doctor and found that 82.4 per cent of the total had some complication of pregnancy or concurrent disease when they first

TABLE III

NEW YORK STATE 1932		NORTH CAROLINA 1933	
KOSMAK		HAMILTON	
285 DEATHS		268 DEATHS	
30%	Sepsis	19%	
24%	Hemorrhage	13%	
23%	Toxemia	43%	

saw their physician and that only 17.6 per cent reported for examination when they were presumably well. "If we assume that adequate prenatal care must begin before the end of the fourth month of pregnancy, only 74 of the 1,396 having answered this question gave their physician a fair chance to give them protection. This constitutes only 5.2 per cent of the total. In the second report approximately 9 per cent of the small number included in that study reported to the physician before the end of the fourth month. It is evident that we have not yet made progress in our efforts to provide adequate prenatal care to those of our citizens who are creating new life."

In previous papers<sup>13, 14</sup> we have given our statistics, and emphasized the similarities and differences between our series of late toxemias, drawn largely from rural North Carolina, and those of other investigators. Lately our attention has been focused on certain characteristics which seem fairly constant. We have been struck with the number of patients with eclampsia who have been in a very poor state of nutrition. They have not been so often the plethoric, stout individuals that fulfill the classic description of the eclamptic type. On checking the localities from which they have been referred and on reviewing the state morbidity and mortality statistics, we have found that in the same areas in which eclampsia occurred most often we were likely to find a large percentage of pellagra and similar diseases. On close and repeated questioning and investigation, we found that the patient that we see in eclamptic convulsions has come from the same group who subsisted on a pellagra-producing diet. Ruffin and Smith<sup>15</sup> have written in detail on pellagra and deficiency diseases in this state. Table IV gives the death rate from pellagra in women in childbearing age in North Carolina.

TABLE IV. DEATHS FROM PELLAGRA IN WOMEN OF CHILDBEARING AGE

1931	275	1934	155
1932	167	1935	174
1933	150	1936	165

These figures (Table IV) are quite similar to the late toxemia deaths. The analogy approaches even more closely when the diet is analyzed in more detail (Table V).

Thus we see that the diet is grossly deficient in all the vitamins especially A, C, and D, as well as being inadequate in the minerals. The energy producing elements are adequate as a whole but there is



a protein deficiency. The animal protein consists chiefly of pork which varies with the season. It is over abundant in the Fall and Winter but inadequate in the Summer. With no sharp demarcation there are three dietary groups of patients in North Carolina: the intelligent economically capable, the fairly cooperative adequately nourished, and the uninformed improperly nourished medically inarticulate group. We have rarely found toxemia in the first two, but it is the prime factor in maternal mortality in the last. We suggest that the incidence of the malnourished pregnant women who do not seek medical attention and who develop late toxemia and of those with deficiency disease may simply be parallel.

TABLE V

ARTICLE	QUAN- TITY (GM.)	PRO- TEIN (GM.)	CARBO- HYDRATE (GM.)	FAT (GM.)	MINERALS (GRAMS)			VITAMINS				
					CA	P	FE	A	B	C	D	G
Corn meal	92	8.3	69.0	2.0	0.011	0.1225	0.0006	+				±
Cane syrup	105		89.2					+				+
Flour	111	12.5	83.4	1.2	0.022	0.1030	0.0010	+				-
Lard	81			81.0				-				-
Rice	25	2.0	19.6	0.1	0.0023	0.0240	0.0002	-				-
Field peas	90	19.2	54.6	1.4	0.0756	0.0760	0.0052	+	++			+
Hominy grits	51	4.3	40.6	0.3	0.0056	0.0734	0.0005	+				-
Fat salt pork	60	1.1	0.0	51.3	0.0011	0.0115	0.0001	-				-
Calories	2890.0											

Adequate and regulative diet is of prime importance in both groups. Urinalysis, blood pressure, and weight recording and various blood estimates are informative. We feel that even though we should carry out a most comprehensive antenatal routine (Irving<sup>16</sup>) and not be able to arrange and supplement the diets of the patients described, we would probably find symptoms of late toxemia of pregnancy developing in a greater proportion among this class of patients. However, Theobald<sup>17</sup> in three years saw only 7 or 8 cases of eclampsia, while in charge of the largest obstetric service in Siam, yet all types of infections especially urinary infection were present in the pregnant patients. The diet was deficient in vitamins A and B. His observations of the habits of women in Siam are most enlightening.

We wrote to our confreres in five widely divergent localities within the State and found that there were 44 toxemic deaths in one year. These counties had a total of 77 deaths from pellagra 35 of which were in women in the childbearing age.

We have investigated our hospital records (Watts, Salvation Army and Duke) for four years and found that 160 females have been treated for pellagra. Only seven of them were pregnant and one of the seven had symptoms of late toxemia. One patient had sprue. During the same period of time there were 2,120 patients delivered in these hospitals and 154 patients with late toxemia of pregnancy. Our mortality rate for this complication was about 13 per cent.

We have analyzed in some detail the progress of patients who have been delivered at the maternity home. These patients came from the rural districts and as a rule were single and arrived at the hospital in a very poor state of nutrition, due to the worry of being pregnant, poor home conditions, not eating in the hope of not gaining weight, and not having received medical attention. The home was operating on a very small budget and had difficulty in supplying the actual food and accessory factors that could improve and overcome this condition. An analysis of 200 cases from 1931 to 1933 records showed an astounding incidence of toxemia. Thirty cases developed symptoms and signs of toxemia, viz., headache, epigastric pain, edema, scotomata, general malaise associated with a rise in diastolic blood pressure above 90, a rise in systolic pressure above 140 and albuminuria, and of these 16 cases showed moderate to marked pitting edema, elevation of blood pressure and albuminuria and fell definitely into a preeclamptic group. Five patients had eclampsia, 4 had severe generalized convulsions before delivery, and 1 developed convulsions twenty-four hours following delivery.

Since many of the cases had been under observation for three to four months and since 28 of the 30 patients with toxemia showed progression of symptoms during their stay at the hospital, an opportunity was offered to study the environment conducive or contributing to this disorder.

Blood studies observed over periods of twelve weeks showed moderate to severe secondary (microcytic) anemia in 21 per cent of the cases. The initial determination of red blood cells in these cases showed a variation in red blood cells from 2,090,000 to 3,970,000 with an average of 3,400,000. Since there had been no history of blood loss, and since the diet in all cases had been questionably to definitely deficient in iron containing foods and the anemias were more severe than the physiologic anemia of pregnancy, they were thought to be nutritional. With improvement in the general economic conditions, helpful suggestions as to the diet and added personnel there has been a decrease in the incidence of toxemia. The institution's diet is now considered adequate remembering that the prophylactic dose of the vitamins and accessory factors is less than the curative.<sup>18</sup>

This series of experiments was performed in order to compare the effects of an ordinarily adequate diet with those of a questionably adequate diet upon the incidence of toxemias of pregnancy in a group of young women. The uniformity of the group lay in the parity, in the age range (sixteen to twenty-two), origin in about the same lower economic and social stratum of society, and an absolutely uniform environment during the period of our study within the confines of a small charitable institution.

Emphasis was recently laid by Strauss<sup>19</sup> upon the possible rôle played by the protein intake and the level of the plasma proteins in the development of water retention as one of the important manifestations of toxemias of pregnancy. By feeding 15 women with toxemia of pregnancy, a very high protein diet (260 gm.) supplemented by parenteral administration of liver extract as a source of vitamin B complex, Strauss was able to induce in all three patients loss of weight attributable to a loss of edema together with a disappearance of symptoms of toxemia.

Since a diet containing 260 gm. of animal protein (meat, fish, eggs, milk) was both economically and physically impracticable, especially in the lower economic strata of the population, we attempted to render a diet which (1) was barely adequate in regard to protein, vitamins, and minerals, (2) liberally adequate in these respects and yet keeping it within the limits of availability to even moderately poor families. With this purpose in view the regular diet of the institution was taken as basic or control for this group of patients.

The 56 patients in this study received the regular diet of the institution under the supervision of a competent matron and of a nurse. This diet, a record of which was kept in a daily menu sheet, represented that common to charitable institutions maintained on a very limited budget. There was an abundance of the cheaper items, such as bread and cereals, but great restriction in regard to the more expensive items such as fresh fruit, milk, butter, eggs, meat, and fish products. During the winter season fresh vegetables are also limited. It is to be noted that the attitude of the staff toward the patients was a highly benevolent and kindly one, and the patients were permitted to eat all they wanted of the foods that were abundantly available, chiefly bread, cereals, potatoes, and some vegetables. This is illustrated in the dietary for one week for two patients given in Lists I and II. These were chosen as illustrative in a contrasting way of the intake of food of a patient with a good healthy appetite and of one with a poor appetite. An estimate of the average daily intake in terms of grams of protein, fat, and carbohydrate and of the caloric values is also indicated. Allowing for individual variations in appetite, the consumption was 35 to 70 gm. protein, 46 to 106 gm. fat, 102 to 266 gm. carbohydrate, and 964 to 2080 calories.

As far as the caloric intake goes it was obviously more than ample to take care of the actual needs of these women all of whom were inactive, even after taking into account the increased basal metabolism in the last months of pregnancy (summarized by A. W. Rowe<sup>20</sup>). The adequacy of this diet in regard to proteins, minerals, and vitamins, was less certain. According to Sherman<sup>21</sup> "There seems to be little if any need for increasing the ordinary intake of protein during

## LIST I

Frances: Poor appetite. Self-restricted diet.

## Breakfast 1/4/37

2 slices bread  
1 slice butter  
1 cup coffee  
1 cup milk  
1 apple

## Lunch

1 bowl soup  
1 slice bread

## Supper

3 slices French toast  
1 slice butter  
syrup

## Breakfast 1/5/37

1 egg  
 $\frac{1}{2}$  cup coffee  
 $\frac{1}{2}$  slice butter  
1 glass milk

## Lunch

1 serving meat  
2 slices bread

## Supper

2 slices bread  
1 slice butter  
1 slice bologna  
1 glass milk  
1 choc. pudding

## Breakfast 1/6/37

1 slice bread  
1 apple  
1 glass milk  
 $\frac{1}{2}$  cup coffee

## Lunch

1 piece bread  
1 small potato  
1 small serving gravy

## Supper

1 glass milk  
1 serving potatoes  
1 dessert (apple sauce)  
1 slice bread and butter

## Breakfast 1/7/37

1 glass milk  
1 egg

## Lunch

1 serving slaw  
1 serving macaroni  
1 serving tomatoes  
1 potato

## Supper

1 serving corn pudding  
1 roll  
1 slice butter  
1 dessert (pears and cake)

## Breakfast 1/8/37

$\frac{1}{2}$  grapefruit  
 $\frac{1}{2}$  roll  
 $\frac{1}{2}$  cup coffee  
1 glass milk

## Lunch

1 potato  
1 slice meat

## Supper

1 bowl beans  
 $\frac{1}{2}$  slice bologna  
2 slices bread  
1 slice butter  
1 dessert  
1 glass milk

## Breakfast 1/9/37

1 apple  
1 glass milk  
1 cup coffee

## Lunch

1 serving rice  
1 serving peas  
1 serving gravy  
1 serving meat  
3 slices bread

## Supper

1 serving peas  
1 serving tomatoes  
1 serving jam  
1 slice butter  
5 biscuits  
1 glass milk

## Breakfast 1/10/37

1 egg  
 $\frac{3}{4}$  slice butter  
 $\frac{1}{2}$  grapefruit  
1 cup coffee

## Dinner

2 serving peas  
1 serving  
pickles  
potato chips

## LIST II

## DIETS SALVATION ARMY HOSPITAL

Irene: Liberal diet, good appetite.

## Breakfast 12/22/36

- 1 bowl cornflakes
- 2 rolls
- 1 egg
- 1½ slice butter
- 2 cups coffee

## Lunch

- 1 serving rutabagas
- 1 serving string beans
- 1 serving sweet potatoes
- 1 serving gravy
- 1 slice meat
- 3½ rolls

## Supper

- 1 bowl peas
- 3 slices bread
- 2 slices butter
- 1 serving potatoes
- 1 dessert
- 1 glass milk

## Breakfast 12/23/36

- 3 slices of bread
- 1 slice of butter
- 1 bowl of cream of wheat
- milk and sugar
- 1 orange
- 2 cups of coffee

## Lunch

- 3 slices of bread
- 1 serving of peas
- 1 serving of potatoes and gravy
- 1 slice of meat

## Supper

- 1 bowl beans
- 1 slice bologna
- 3 slices of bread
- 1 slice of butter
- 1 dessert, pears
- 1 glass sweet milk
- 2 cakes

## Breakfast 12/24/36

- 1 bowl oatmeal
- milk and sugar
- 4 slices bread
- 1½ slice butter
- 1 apple
- 2 cups coffee
- milk and sugar

## Lunch

- 4 slices bread
- 1 serving potatoes
- 1 serving cabbage
- 1 serving gravy
- 2 wieners

## Supper

- 1 bowl beans
- 3 slices bread
- 1½ slice butter
- 2 slices sausage
- 1 glass sweet milk
- 1 dessert, pudding

## Breakfast 12/25/36

- 1 bowl cornflakes
- milk and sugar
- 1 egg
- 5 slices bread
- 1½ slices butter
- 2 cups coffee

## Christmas Dinner

- 8 slices bread
- 1 serving of cranberries
- 1 serving of turkey
- 1 serving of dressing
- 1 serving of peas
- 2 servings of potatoes
- 3 servings of gravy
- "Eating all Day"
- Ice cream and cake, nuts, candy,
- raisins

## Breakfast 12/26/36

- 1 bowl farina
- milk and sugar
- 4 slices bread
- 1½ slices butter
- 2 cups coffee
- 1 orange

## Lunch

- 1 serving peas
- 1 serving potatoes creamed
- 2 wieners
- 4 slices of bread with gravy

## Supper

- 2 bowls peas
- onions
- 1 slice bologna
- 5 slices bread
- 2 slices butter
- 1½ glass milk
- 1 rice pudding
- 1 orange

## Breakfast 12/27/36

- 1 bowl cornflakes
- milk and sugar
- 1 egg
- 4 slices bread
- 1 slice butter
- 1 orange
- 2 cups coffee



## Lunch

- 1 serving beans
- 1 serving potatoes
- 1 serving turkey
- 1 serving dressing
- gravy
- celery
- 4 slices bread

## Supper

- 1 bowl beans
- 1½ slice butter
- 3 slices bread
- 1 glass milk
- 1 dessert

## Breakfast 12/28/36

- 1 bowl oatmeal
- milk and sugar
- 3 slices bread
- 1 slice butter
- 2 cups coffee
- milk and sugar
- 1 apple
- candy

## Lunch

- 1 large serving turkey pie
- 1 serving snap beans
- 1 serving gravy
- 3 servings peas
- 5 slices bread
- candy

## Supper

- 1 bowl turkey soup
- 1 serving Irish potatoes
- 1 serving chicken salad
- 3 rolls
- 1 slice butter
- 1 small serving jelly
- 1 slice cake
- candy and nuts

## Breakfast 12/29/36

- 1 bowl cornflakes with
- milk and sugar
- 2 rolls
- 1 slice butter
- 1 egg
- 2 cups coffee
- milk and sugar

## Lunch

- 1 serving cabbage
- 1 serving beans
- 1 serving potatoes
- 1 serving meat
- gravy
- 3 rolls

## Supper

- 1 bowl beans
- 2 slices bologna
- 2½ rolls
- 1 slice butter
- peach preserves
- 1 glass milk
- 1 dessert (pears with cake)

pregnancy and some reason for caution in doing so. The surplus over actual need which most ordinary dietaries contain seems ample for the needs of pregnancy." (On the other hand Sherman, i.e., 464, quotes Smith (*Lancet* 2: 54, 1916) to the effect that "maternity hospital records have shown that women classified as under-nourished during pregnancy showed greatly increased proportions of stillbirths, of premature births and of deaths of babies within ten days after birth."

It should be noted, however, that by far the largest proportion, estimated as 70 per cent, of the protein was furnished by the cereals and only approximately 30 per cent by meats, milk and eggs. It is conceivable that, while the total amount of protein was adequate, the quality of the protein, or the quantity of the type of protein best suited for replacement of maternal tissue and blood proteins was not entirely adequate. This possibility was borne out by the discovery of the relatively low plasma protein values shown in the charts and discussed later. Also on the basis of our knowledge of the group of the population from which most of the subjects came, the dietary before admission to the hospital of these patients was very likely to have been deficient both in the quantitative and qualitative aspects.

For these reasons it was decided to add to the diet of every other patient in order of admission the following constituents:

- 150 gm. of skimmed milk powder.
- 20 yeast tablets.
- 15 drops of percomorphum oil.
- 2 gm. of bone meal.
- 4 gm. of ferrous sulfate.

These items supplied to each other patient furnish additional: protein 60 gm., carbohydrate 75 gm., fat 2.5 gm. a total of 580 extra calories, and also adequate amounts of vitamins A, B, D, and E as well as of minerals, particularly of calcium phosphorus and iron. The extra protein supplied by the milk is generally considered to be of high "biological value" particularly for growth of new tissue and the formation of milk in lactation. The dried milk was fed either in the form of a custard or a beverage. In order to avoid jealousy and ill feeling on the part of the inmates not receiving the supplementary items, these items were deliberately not made particularly attractive in the form they were served.

The clinical records of these patients are recorded elsewhere. For purpose of the chemical study samples of blood of the patients were secured on admission, usually fourteen to ten weeks before term, every two weeks thereafter, including one sample a few days before delivery, one shortly after delivery, and at two weekly intervals for ten weeks after delivery. Heparin (Hoffman-LaRoche) was used as an anticoagulant.

On these samples the following determinations were made: hemoglobin (Sahli method), red blood cell count, hematocrit, total protein, albumin by a macromodification of Howe's method<sup>22</sup> and nonprotein-nitrogen of the plasma by the usual Folin-Wu method, total fat by Wilson and Hanner's method,<sup>23</sup> the iodine number of the fat by Yasuda's method,<sup>24</sup> cholesterol by Schapiro, Lerner and Posen's modification of Schonhumer and Sperry's method,<sup>25</sup> phospholipids by a combination of the digestion technic of King,<sup>26</sup> and the colorimetric determination of the phosphorus by the method of Fiske and Sabbarow.<sup>27</sup>

These particular chemical values were selected in the hope that they would reflect the nutritional influences of the diet upon the maternal organism more closely than the others which had been previously studied in normal pregnancy and in toxemias.

For purposes of summarizing the results of these studies, they were treated in four groups on the basis of diet and type of delivery.

- Group I: Control diet, normal delivery, 15 cases.
- Group II: Control diet, toxic delivery, 11 cases.
- Group III: Enhanced diet, normal delivery, 18 cases.
- Group IV: Enhanced diet, toxic delivery, 9 cases.

Toxic delivery means that the patient had signs and symptoms of late toxemia at the time of delivery, elevation in blood pressure to 140/90,

edema, headache, and albumin in the urine. There were six patients in this series who had evidence of nephritis or hypertension on admission, four were placed on augmented diet and two on regular diet. All six showed a progressive increase in symptoms and were included in the toxic series. Since no strikingly consistent differences were found in the figures for the above enumerated analyzed constituents only a graphic representation of the values averaged for each of the above groups is given in the figures below (Charts 1, 2, and 3). The analytical results for each individual were tabulated by the above designated four groups. Within each group and for each item the

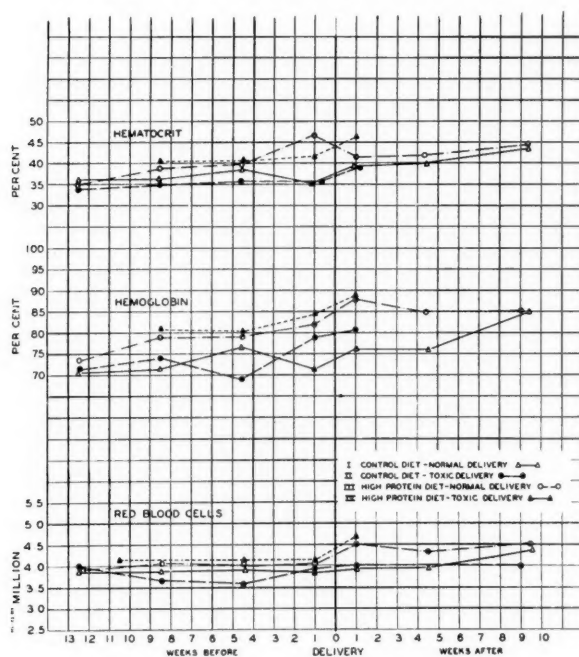


Chart 1.

figures were averaged as they fell into the following periods: antepartum sixteenth through eleventh week, tenth through seventh week, sixth through third week, second through parturition, parturition first two weeks, next four weeks, and next four weeks through the tenth week postpartum. The points given in the figures are averages so obtained.

#### DISCUSSION OF CHEMICAL DATA

A. *The Hematologic Data.*—(Chart 1.) The red blood cell count, hemoglobin, and hematocrit, while not showing very great differences for the groups, do show: (1) The frequently observed lowering of all of these values, probably due to dilution of the blood as suggested by Dieckmann and others,<sup>28</sup> with a return towards normal levels postpartum; and (2) a tendency to the lowest values observed in this study

in the antepartum period for the two groups on the control (lower protein) diet and consistently higher values for the two groups on the protein and vitamin reinforced diet.

B. *The Plasma Protein and Albumin Data.*—(Chart 2.) Here we observe the general tendency for low protein values, the figures averaged for all four groups at fourteen weeks antepartum are compared in Table VI with the average values at ten weeks postpartum and with the accepted average values for the plasma proteins of normal nonpregnant women as given by Peters and Van Slyke.<sup>29</sup> This is more marked in our general series of toxemia patients and was noted by Dieckmann<sup>30</sup> who ascribed it to a probable nutritional basis.

The colloid osmotic pressure of the proteins was calculated according to the formula proposed by Wells, Youmans and Miller<sup>30</sup> for purposes of comparison with Strauss's data.<sup>1</sup>

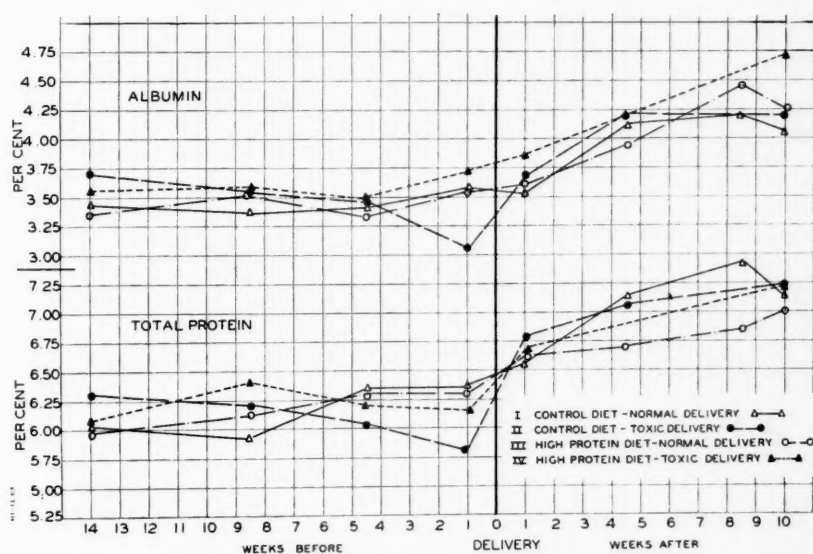


Chart 2.

Our figures for the plasma proteins in the fourteenth week antepartum agree fairly well with those found in the literature (ably reviewed by Dieckmann and Wegner<sup>31</sup> showing a general decrease as compared with values for normal non-

TABLE VI

	AVERAGE 14 WEEKS ANTEPARTUM 29 CASES	AVERAGE 10 WEEKS POST PARTUM 19 CASES	AVERAGE NONPREGNANT WOMEN (9) 16 CASES
Total protein, gm. per cent	6.1	7.1	7.0
Albumin gm. per cent	3.5	4.3	4.3
Globulin gm. per cent (by difference)	2.6	2.8	2.7
A/G ratio	1.35	1.53	1.59
Colloid osmotic pressure, cm. H <sub>2</sub> O	256	330	328

pregnant women. This decrease is almost entirely at the expense of the osmotically more active albumin fraction, and is thus reflected in the figure for colloid osmotic pressure.

An examination of the plasma protein curves for the four groups reveals that the ingestion of the extra milk protein, vitamins, and salts had no appreciable effect on the general level, with the notable exception that immediately antepartum Group II of 11 patients on the control (low protein) diet, who developed toxemic symptoms, also showed on the average the lowest proteins (total protein 5.8 per cent, albumin, 3.05 per cent, globulin [by difference] 2.75 per cent, A/G ratio 1.1, osmotic

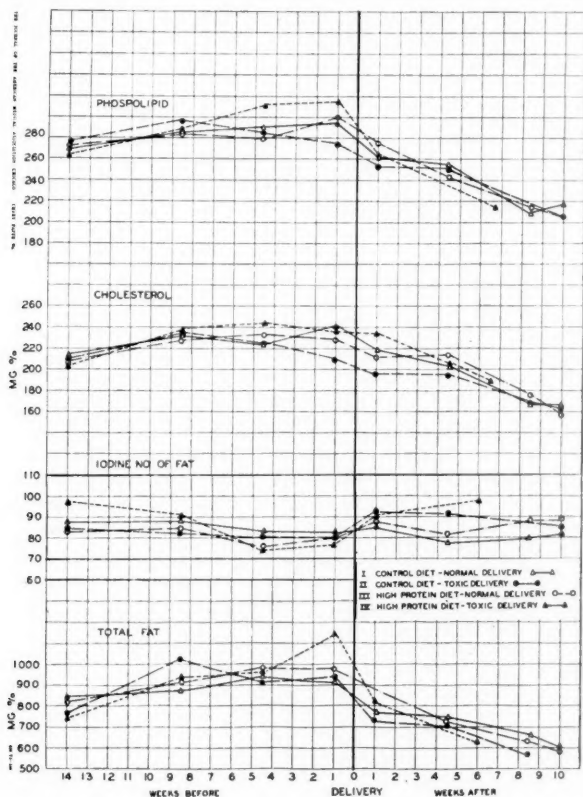


Chart 3.

pressure [calc:] 228 cm.  $H_2O$ ). It should be noted, however, that Group IV of 9 patients on the high protein diet, who also developed toxemic symptoms, did not show this marked lowering of the plasma proteins as compared with the two groups without toxemic symptoms.

The return of the plasma protein values towards a normal level regardless of type of diet and in spite of the drain of lactation and nursing in this series is quite remarkable and is indicative perhaps of the possibility that the basic control diet used was quite adequate to maintain a normal plasma protein level. It will be noted also that the relative rate of increase of the concentration of the plasma proteins postpartum was much greater than the rate of increase in the hemoglobin and red blood cells. This observation points toward an essential difference in the



mechanisms of the apparent regeneration of the plasma proteins and of the red blood cells apart from the mechanical factor of the increased hydremia antepartum, designated as "oligocythemie hypervolemia" by Dieckmann and Wegner.<sup>28</sup>

*C. The Plasma Fate and Lipin.*—The curves in Chart 3 for the average values in the four groups confirm in general the established tendency towards hyperlipemia in pregnancy. This subject was recently reinvestigated and reviewed by Boyd.<sup>32</sup> While, in common with other observers, large individual variations were found in this study in all four groups, the total lipin, cholesterol and phospholipid values, already considerably above normal levels at the beginning of our observations in the fourteenth week antepartum, tended to increase still further until parturition and fall to normal levels postpartum. No striking differences were found which could be accounted for either on the basis of diet or of presence or absence of toxemic symptoms. The only general observation which can be made is that in pregnancy, as in other conditions involving hypoproteinemia notably in nephrosis and in other forms of water retention, there appears to be a tendency towards a concomitant hyperlipemia. This may or may not be an expression of an attempt on the part of the organism to compensate for the fall in the colloid osmotic pressure due to the hypoproteinemia as suggested by Fishberg.<sup>33</sup> But as pointed out by Boyd<sup>32</sup> the true cause of hyperlipemia of pregnancy is still obscure. The curves of the iodine number values of the total plasma fat appear to vary inversely as the values for the total fats. This indicates that the increase antepartum and the fall postpartum in the plasma fatty acids is largely accounted for by the saturated fatty acids, as was previously observed in a study of the lipins in hyperthyroidism by Nicholls and Perlzweig.<sup>34</sup> This undoubtedly points to changes in the ratio of saturated to unsaturated plasma lipins, but the significance of this factor for the physicochemical equilibrium of the blood is as yet not clear.

The weight gain over a period of three months antepartum averaged 15 pounds in the group receiving the augmented diet and 12 in the regular diet group. Edema was noted more often in the latter group.

There was little difference in the blood pressure readings of the two groups. As a rule, it was low, 100 to 114 systolic and 60 to 70 diastolic. In the toxemia group we naturally found an increase of pressure, more pronounced in the diastolic figure, as well as an unusual weight gain—in one instance 50 pounds in three months.

#### CONCLUSIONS

Puerperal albuminuria and eclampsia account for the highest percentage of maternal deaths in North Carolina.

Lack of prenatal care is the prime factor in these deaths.

The incidence of toxemia of pregnancy and nutritional diseases parallel in this state.

It appears from this study on 54 young primiparae that the addition of dried milk, vitamins, calcium, and iron to a diet which may be regarded as marginal in regard to protein, vitamins and minerals did not exert an appreciable effect on the incidence of toxemic symptoms. Nor were there observed any significant effects upon the blood cells, hemoglobin, and dilution, nor upon the concentration of the plasma proteins, fats, and lipids. The most likely explanation for this prob-

ably lies in the fact that the basic diet upon which these additional desirable dietary factors were superimposed was not in the true sense of the term a deficient one.

We wish to thank Dr. Warren Cox, Jr., and the Mead Johnson Company for their generosity in supplying the supplemental diet; Miss Rachel Stephen and Mrs. McClees for their technical aid and the staff of the Salvation Army Maternity Home for their cooperation.

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## RESPIRATION AND PULMONARY VENTILATION IN NORMAL NONPREGNANT, PREGNANT, AND PUERPERAL WOMEN\*

WITH AN INTERPRETATION OF THE ACID-BASE BALANCE DURING  
NORMAL PREGNANCY

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THE total respiratory metabolism in pregnant and nonpregnant women has been thoroughly studied, but little attention has been directed toward associating the altered respiratory gaseous exchange with the acid-base balance during gestation.

Magnus-Levy,<sup>1</sup> Zuntz,<sup>2</sup> Klaften,<sup>3</sup> Rowe, Gallivan, and Matthews,<sup>4</sup> Schroeder,<sup>5</sup> and Berconsky and Rossignoli<sup>6</sup> have shown that the amount of air respired per minute increases progressively during pregnancy but returns to normal levels promptly after delivery. These reports also indicate that there is usually a slight increase in the respiratory rate, associated with a more marked increase in the tidal air (the volume of air involved in a single respiration). Certain of these investigators<sup>1-3, 6</sup> found that the percentage of CO<sub>2</sub> in the expired air remains quite constant during gestation, while the minute volume of CO<sub>2</sub> produced increases. It has also been observed that the percentage of O<sub>2</sub> absorbed from the inspired air is diminished slightly, although the total volume absorbed per minute is increased, thereby producing variable and probably insignificant variations in the volume of O<sub>2</sub> absorbed per minute per kilogram of body weight.

The present communication offers further data on the respiratory gaseous exchange in pregnant and early puerperal, as compared with normal, nonpregnant women, and attempts to interpret the acid-base balance of the blood during pregnancy in terms of alterations in the respiratory exchange.

The interest of one of us (E. D. P.) in this problem developed from a critical survey of data compiled during an earlier investigation of the basal metabolism during pregnancy,<sup>7</sup> using the method described by Bailey,<sup>8</sup> which is essentially that of Boothby and Saniford.<sup>9</sup> The expired air was collected in a Tissot spirometer, and the CO<sub>2</sub> and O<sub>2</sub> were determined in duplicate with the Henderson-Haldane gas-analysis apparatus. All tests were made in the morning after ten to twelve hours fasting and after a preliminary rest period. A total of 290 determinations were made on 56 normal pregnant and puerperal women. These patients usually reported at four-week intervals during pregnancy, in many instances from the third lunar month, and at seven-day intervals

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after delivery, thus permitting several observations on each individual. Routine determinations included height and weight, respiratory rate, total volume of respired air per unit of time, and the  $\text{CO}_2$  and  $\text{O}_2$  content of the expired air. These data permitted calculation of the minute volume of respired air, and the amount of the tidal air, while the  $\text{CO}_2$  produced and the  $\text{O}_2$  absorbed were computed per kilogram of body weight and per square meter of body surface area. The ratio between the minute volume of respired air and the total  $\text{CO}_2$  produced per minute was used as an index of the degree of hyperventilation.

Table I shows that there was little change in the respiratory rate during the thirty weeks of pregnancy for which average values are available, but that during the same interval the tidal air increased by approximately 28 per cent (from 265 to 339 c.c. per respiration). The minute volume of air passed through the lungs increased 26 per cent, although in terms of square meters of body surface the increase was only 11 per cent, and in terms of kilograms of body weight it was insignificant. The ventilation ratio remained practically constant, although as compared with values obtained in the late puerperium there was a considerable increase. Apparently the respiratory changes incident to pregnancy make their appearance in the very early weeks after conception.

Associated with these alterations in ventilation, there were definite changes in the composition of the expired air. The percentage of  $\text{CO}_2$  remained at a low level (3.03 to 3.15 per cent) from the 12th to the 40th week of pregnancy, whereas in the postpartum period it approached the normal nonpregnant level, ranging from 3.30 to 3.98 per cent. There was an associated rise in the amount of  $\text{CO}_2$  expired per minute and per square meter of body surface, although the amount per kilogram of body weight was scarcely altered.

The percentage of  $\text{O}_2$  absorbed decreased slightly from the twelfth week of pregnancy, when it was already considerably below the nonpregnant level as represented by readings obtained after the second postpartum week. At the same time, the absolute amount of  $\text{O}_2$  absorbed per minute increased during pregnancy and fell again after delivery. When calculated per kilogram of body weight, the absorption of  $\text{O}_2$  was highest in the third and fourth lunar months of pregnancy, gradually decreased during the remainder of gestation, and showed a further fall in the postpartum period. On the other hand, the absorption of  $\text{O}_2$  per square meter of body surface increased slightly from the twelfth to the fortieth weeks of pregnancy and then fell rather considerably after delivery.

It is postulated that these unexpected variations in gaseous exchange may be due to the fact that the rapid increase in body weight during gestation is due largely to fat deposition and water retention. The

TABLE I. THE RESPIRATORY GASEOUS EXCHANGE IN NORMAL NONPREGNANT, PREGNANT, AND PUERPERAL WOMEN. (HENRY FORD HOSPITAL SERIES) (AVERAGE VALUES)

MATERIAL	NUMBER OF DETERMI- NATIONS	BODY WEIGHT	BODY SURFACE AREA	RATE OF RESPIRATION	VENTILATION						CARBON DIOXIDE EXPIRED						OXYGEN ABSORBED				
					PER MINUTE	PER MINUTE PER KILOGRAM OF BODY WEIGHT	liters	liters	ml.	RATIO: VENT. CO <sub>2</sub> PER MIN.	per cent	ml.	PER MINUTE	PER MINUTE PER KILOGRAM OF BODY WEIGHT	ml.	per cent	ml.	PER MINUTE	PER MINUTE PER KILOGRAM OF BODY WEIGHT	ml.	PER MINUTE PER SQUARE METER OF BODY SURFACE AREA
Pregnant (Weeks after last men- strual period):																					
iii (Ninth to twelfth incl.)	14	53.5	1.53	18.4	4.88	91.1	3.19	265	32.5	3.08	150	2.81	98	4.74	232	4.33	151				
iv (Thirteenth to six- teenth incl.)	28	55.2	1.57	18.3	5.04	91.2	3.22	275	32.3	3.10	156	2.83	100	4.72	238	4.31	152				
v (Seventeenth to twentieth incl.)	43	58.9	1.60	18.4	5.23	88.9	3.25	284	32.6	3.06	160	2.72	100	4.60	241	4.08	150				
vi (Twenty-first to twenty-fourth incl.)	44	60.1	1.62	18.5	5.33	88.6	3.29	288	31.9	3.13	167	2.78	103	4.66	249	4.13	153				
vii (Twenty-fifth to twenty-eighth incl.)	46	62.4	1.65	18.4	5.50	88.2	3.34	299	32.3	3.10	170	2.73	103	4.54	249	4.00	152				
viii (Twenty-ninth to thirty-second incl.)	40	65.0	1.67	18.6	5.80	89.3	3.47	312	32.2	3.10	180	2.77	108	4.50	261	4.02	155				
ix (Thirty-third to thirty-sixth incl.)	43	66.8	1.70	18.7	6.05	90.5	3.56	323	31.9	3.15	190	2.85	118	4.51	273	4.08	160				
x (Thirty-seventh to fortieth incl.)	32	66.6	1.69	18.5	6.17	92.6	3.65	339	33.0	3.03	187	2.80	111	4.36	269	4.04	159				
Puerperal (Weeks after the de- livery):																					
First	29	60.2	1.62	17.5	5.18	86.1	3.20	296	30.3	3.30	171	2.84	105	4.66	242	4.02	150				
Second	52	59.6	1.60	17.3	4.66	78.2	2.90	270	28.6	3.50	163	2.74	102	4.85	226	3.80	141				
Third	26	58.2	1.60	16.8	4.20	72.2	2.62	250	25.1	3.98	167	2.87	104	5.15	216	3.72	141				
Fourth, fifth, sixth	6	56.0	1.58	18.3	4.20	75.0	2.66	230	27.6	3.62	152	2.75	96	5.00	210	3.75	133				
Seventh to fourteenth incl.	12	60.2	1.61	17.7	4.40	73.2	2.73	248	28.6	3.49	154	2.55	95	5.11	225	3.74	140				



slight increase in oxygen absorption and in carbon dioxide production per square meter of surface area explains the moderate rise in the basal metabolic rate during the latter half of pregnancy and may be related to the metabolism of the rapidly growing fetus.

Since these older values were calculated from work sheets prepared in the routine performance of basal metabolism tests by trained technicians, it was thought wise to repeat the work under research conditions. The original technic was followed as closely as possible and all determinations were made by one of the authors (F. W. O.). Obstetric patients were available only during the last month of pregnancy and for the first ten days after delivery. Twenty-two normal primigravidae and 23 multigravidae were studied before delivery and 10 primiparae and 11 multiparae after delivery. In addition, 20 normal nonpregnant women (nurses and laboratory technicians) were available as controls.

The average results are recorded in Table II. The minute volume of respired air is markedly increased over the nonpregnant average (45 per cent in the primigravidae and 43 per cent in the multigravidae). This increased air exchange is associated with a rise in the tidal air, even though the respiratory rate is increased from 14 to 16.5 (average) per minute. The percentages of  $O_2$  absorbed and of  $CO_2$  produced are decreased, probably as a result of the augmented air exchange, while the volumes exchanged per minute are increased. There is also an increase in the volume of gaseous exchange per square meter of body surface and per kilogram of body weight. The ratio of the minute volume of respired air to the volume of  $CO_2$  produced (an index of the degree of hyperventilation) rises from 31.2 in the nonpregnant to 35.4 in each group of pregnant women, an increase of 4.2 c.e., or 13.4 per cent.

The data show relatively little difference between primigravidae and multigravidae, except that both the total gaseous exchange and the tidal air are slightly greater in the former.

In the puerperal women (five to ten days after delivery) the average values tend to approach the nonpregnant level, which in certain instances is actually reached.

While there are certain differences between the two series, they are in general confirmatory, and demonstrate that there are certain consistent changes in gaseous exchange during gestation: (1) The tidal air increases, contrary to the popular belief that the upward pressure of the pregnant uterus restricts the capacity of the chest cage. Apparently the lateral expansion of the chest wall more than compensates for the upward displacement of the diaphragm. (2) More air passes through the lungs per unit of time. This is an expression of the increased tidal air plus the increase in the respiratory rate. (3) The  $O_2$  absorption and the  $CO_2$  production per unit of time, per minute per kilogram of body weight, and per minute per square meter of body surface are increased during pregnancy, but the increased pulmonary

TABLE II. THE RESPIRATORY GASEOUS EXCHANGE IN NORMAL NONPREGNANT, PREGNANT, AND PUERPERAL WOMEN.  
(UNIVERSITY OF IOWA SERIES) (AVERAGE VALUES)

MATERIAL	NO. OF DETERM- NATIONS	BODY WEIGHT	BODY SURFACE AREA	RATE OF RESPIRATION PER MINUTE	VENTILATION								CARBON DIOXIDE EXPIRED						OXYGEN ABSORBED				
					PER MINUTE	liters	ml.	PER MINUTE PER KILOGRAM OF BODY WEIGHT	PER MINUTE PER SQUARE METER OF BODY SURFACE AREA	TIDAL AIR	RATIO: $\frac{\text{CO}_2}{\text{VENT.}}$ PER MIN.	IN EXPIRED AIR	per cent	ml.	PER MINUTE	ml.	PER MINUTE PER KILOGRAM OF BODY WEIGHT	PER MINUTE PER SQUARE METER OF BODY SURFACE AREA	FROM RESPIRED AIR	per cent	ml.	PER MINUTE	ml.
Nonpregnant	20	55.8	1.58	14.0	4.68	84.0	2.96	334	31.2	3.31	150	2.78	95	4.39	206	3.69	130						
Late pregnant																							
Primigravidae	22	63.1	1.64	16.3	6.78	107.3	4.13	416	35.4	2.83	192	3.04	117	4.04	274	4.34	167						
Multigravidae	23	64.2	1.66	16.9	6.70	104.3	4.04	396	35.4	2.83	189	2.96	114	4.04	271	4.21	163						
Puerperal																							
Primiparae	11	52.9	1.51	16.5	5.17	97.8	3.42	313	33.6	2.99	154	2.92	102	4.07	210	3.97	139						
Multiparae	10	63.4	1.67	16.7	5.57	87.9	3.33	333	32.0	3.12	174	2.74	104	4.18	233	3.68	139						

ventilation leads to a significant reduction in the percentage of oxygen absorbed from and of carbon dioxide added to the air during its passage through the lungs. (4) The ratio of air respired per minute to the  $\text{CO}_2$  expired per minute indicates a considerably increased pulmonary ventilation, which appears in the first trimester of pregnancy and disappears during the first two weeks after delivery.

#### DISCUSSION

Divergent interpretations of the acid-base balance during pregnancy have been presented by two groups of investigators,<sup>10, 11</sup> although it is generally agreed that gestation is accompanied by a fall in the serum bicarbonate content and in the alkaline reserve. Zuntz,<sup>2</sup> Magnus-Levy,<sup>1</sup> and Schroeder<sup>5</sup> noted a definite increase in the minute volume of respired air, while Hasselbalch and Gammeltoft,<sup>12</sup> Rowe,<sup>13</sup> and others,<sup>14, 15</sup> have shown that the  $\text{CO}_2$  tension of the alveolar air is reduced. Bokelmann and Rother<sup>16</sup> have reported that the urine is slightly more alkaline in pregnant than in puerperal women. Stander, Eastman, Harrison, and Cadden<sup>17</sup> found no increase in organic acids or any evidence of the presence of unusual acids in the blood during normal pregnancy. Reported values for the pH of plasma are not in agreement, certain observers recording the hydrogen ion concentration slightly lower than the normal average and others detecting no significant variation.

Muntwyler, Limbach, Bill, and Meyers<sup>18</sup> found the blood pH of normal antepartum women usually slightly above the nonpregnant level and concluded that hyperventilation is responsible for the change. They believe that hyperventilation causes the  $\text{CO}_2$  to be lowered while the base diminishes secondarily as a compensatory reaction.

On the other hand, Kydd, Oard, and Peters<sup>19</sup> object to the assumption that the fall in bicarbonate results from hyperventilation, and offer the following specific criticisms: (1) They, and certain other observers, find that the blood pH values of pregnant women are not elevated. (2) Muntwyler and others studied such heterogeneous material that their average figures are of little significance. (3) The observation of Muntwyler and others, that the elevated pH persists for some days after delivery, although the total base and the  $\text{CO}_2$  content have returned to normal levels, would seem to invalidate their theory concerning the  $\text{CO}_2$  and base deficits, since the high pH would indicate that the hyperventilation persists after disappearance of the  $\text{CO}_2$  deficit, which it supposedly has induced. (4) It has not yet been demonstrated that the  $\text{CO}_2$  deficit of hyperventilation is compensated for by reduction of base. Experiments by Peters, Bulger, Eisenmann, and Lee,<sup>19</sup> and others,<sup>20, 21</sup> indicate that compensation for such a  $\text{CO}_2$  deficit is established by an increase in the chlorides without a change in the total base.

The data here presented tend to confirm the contention that the pulmonary hyperventilation, which is physiologic in pregnant woman, must be a factor in the regulation of the acid-base balance. Due to the gradual development of the increased respiratory exchange and its long duration, a new acid-base equilibrium is established, in which the tendency toward an elevated pH is compensated for by a decrease in the

plasma bicarbonate proportional to the lowering of the carbon dioxide. This compensatory development serves generally to maintain the hydrogen ion concentration within recognized normal limits.<sup>22</sup>

The increased volume of respired air in terms both of body weight and of surface area indicates hyperventilation, as do the accelerated respiratory rate and the increased volume of tidal air. Available data suggest strongly that the hyperventilation is due not to an increased production of  $\text{CO}_2$  by a physiologic acceleration of metabolism, but rather to some other stimulus which increases the respiratory exchange and secondarily lowers the  $\text{CO}_2$  tension. It should be noted that the ratio of the volume of respired air to that of the  $\text{CO}_2$  produced is greater in pregnant than in nonpregnant women, i.e., more air is respired during the removal of a given amount of carbon dioxide. Moreover, Stander and others<sup>17</sup> have shown that there is no increase in organic acids and no accumulation of abnormal acids in the blood of pregnant women which might cause a compensatory hyperventilation. Hydrogen ion determinations also indicate that there are no unusual acids in the circulating blood. Consequently the only known acid which might be responsible for the respiratory alteration is carbonic acid, which, however, is at a lower than normal level in the blood of pregnant women.

The term "hyperventilation," as used in connection with "acid-base balance," is somewhat confusing since it may refer either to forced respiration over a comparatively short interval, producing a picture of alkalosis, or to an accelerated respiratory rate caused by an increased concentration of hydrogen ions. In either instance, the respiratory rate and the minute volume of respired air are increased and the alveolar  $\text{CO}_2$  is reduced. It is well recognized that when the hydrogen ion concentration of the blood is increased, as in uncompensated acidosis, the respiratory center is stimulated and the respiratory exchange is accelerated to "blow off" carbon dioxide. This mechanism alters the ratio between the bicarbonate and the free  $\text{CO}_2$  of the blood and thus tends to restore the normal hydrogen ion concentration. When the low pH is due to acids other than carbonic, the resultant hyperventilation "blows off" the carbon dioxide producing very low  $\text{CO}_2$  tensions in the blood and alveolar air without materially affecting the hydrogen ion concentration of the blood.

The fact that there is no increase in acids in the blood in normal pregnancy leads to the conclusion that the hyperventilation during gestation is not due to an increased hydrogen ion concentration, i.e., an acidosis, but rather to some unknown stimulus. Hyperventilation produced by stimuli other than an increased acidity can lower the  $\text{CO}_2$  tension, as is demonstrated in experiments involving voluntarily forced respirations, when the ratio of bicarbonate to free carbonic acid is disturbed and the blood pH rises promptly, due to the fact that the bicarbonate decreases less rapidly than the carbon dioxide. The excess

alkali in the blood is gradually excreted through the kidneys, producing a less acid urine and resulting finally in the restoration of the normal acid-base balance.

In normal pregnant women, the hyperventilation is mild and continues over several months, during which the bicarbonate is decreased in proportion to the reduction of the  $\text{CO}_2$  content, and the blood maintains a normal pH. When, as in some of the cases reported by Muntwyler and others,<sup>18</sup> the blood pH is above normal, it would seem reasonable to assume some interference with the usual compensatory reduction of the concentration of bicarbonate, although it is to be expected that this protective mechanism would be operative and effective in the majority of normal women.

Our data indicate that the physiologic hyperventilation of pregnancy does not cease abruptly with delivery, but disappears gradually during the first two weeks of the puerperium. This observation probably explains the findings of Muntwyler and others<sup>18</sup> who noted a slightly elevated pH in certain women after delivery, even though the bicarbonate and total base had returned to normal, and there was a slight increase in the total acids of the blood.

#### SUMMARY

1. The respiratory rate is increased slightly from the fourth lunar month of gestation to term.
2. The volume of tidal air and the minute volume of respired air increase progressively during pregnancy and return to normal during the second week after delivery.
3. The minute volumes of  $\text{CO}_2$  produced and of  $\text{O}_2$  absorbed increase gradually during pregnancy and approach the normal nonpregnant level from one to two weeks postpartum.
4. The ratio of the minute volume of respired air to the  $\text{CO}_2$  expired is greater in pregnant than in nonpregnant women. One week after delivery this ratio is less than during pregnancy but still greater than in nonpregnant controls.

#### CONCLUSION

The acid-base balance of the blood of normal pregnant women represents a condition of compensated  $\text{CO}_2$  deficit due to physiologic hyperventilation. The long period of pregnancy results in an equilibrium in which a potentially increased pH, due to hyperventilation, is returned to normal by a lowered plasma bicarbonate and a proportionately decreased carbonic acid.

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## DISCUSSION ON PAPERS BY DRS. ROSS AND PLASS

DR. NICHOLSON J. EASTMAN, BALTIMORE, MD.—Of the several changes which take place in the blood during pregnancy, the reduction in the carbon dioxide content of the serum is one of the most constant. Since the report by Oard and Peters in 1929, it has been known that this fall in carbon dioxide is paralleled by a diminution in the total base of the serum. This reduction amounts to about 8 mm., or 5 per cent.

Dr. Plass has now shown us very clearly that a marked degree of hyperventilation occurs in pregnancy and postulates that this causes both the fall in the carbon dioxide content of the serum and the fall in total base. That hyperventilation causes the fall in carbon dioxide is plausible enough since part of the carbon dioxide is present as free carbonic acid gas and could be easily blown off. But whether it is also responsible for the fall in the basic radicles is a more difficult question. The chronic hyperventilation which occurs in persons living at high altitudes is not dissimilar to that seen in pregnancy, and it would seem of interest to inquire into total serum base behavior under these circumstances. The person living at a high altitude breathes faster and deeper in order to get enough oxygen from a rarefied air; the pregnant woman breathes faster and deeper in order to get enough oxygen for her increased blood volume and increased minute output of her heart. Recently Dill and his associates have shown that the most notable change in the electrolytes of the blood at high altitudes is a decrease in the carbon dioxide content. He reports a reduction of 8 mm. This decrease in carbon dioxide is partially balanced by an increase of 4 mm. in serum chloride and a decrease of 2 mm. in sodium, leaving an unexplained anion deficit of about 2 mm. The pH increased slightly. If hyperventilation can cause even this slight decrease in total base at high altitudes, it seems altogether likely that it is responsible for a substantial part or possibly all of the reduction in total base seen in pregnancy. There may be other factors such as blood dilution.

I agree with Dr. Plass that there is no increase in organic acids and no appreciable change in blood pH during normal pregnancy.

In conclusion, I should like to make a few remarks about studies of this general type. When a paper such as this is presented before a clinical group the question naturally arises, what is the practical value of this paper? You will remember when Benjamin Franklin demonstrated electricity to the French salons in Paris their first question was, what is the practical value of this thing you call electricity? And you will remember his famous reply: "Of what practical value is a newborn baby?" And so it is with a work of this type. Although at present it may not seem to have much practical value, there is reason to believe that when work of this type is pieced together the various studies will form a mosaic which will serve as a founda-

tion for investigations of the utmost practical value. If I may say so, it is my firm conviction that this association and American obstetricians in general need more studies on fundamental problems such as these two you have just heard.

DR. PAUL TITUS, PITTSBURGH, PA.—In every research problem carried out so thoroughly as this one has been, I like to look for the practical clinical application of the findings. Plass and Oberst have presented certain specific facts to you; namely, that the pregnant woman's respiratory rate increases progressively from the fourth month onward, as does also the volume of each respiration. They have reasoned logically that this is as physiologic as it is for any of us to breathe more rapidly and more deeply whenever we exert ourselves physically more than usual. When the pregnant woman's race is over, these, with their concomitant blood chemistry changes, quickly return to their normal nonpregnant level.

A clinical conjecture is suggested by this work. Does it not indicate that basal metabolism estimations made in the first four months of pregnancy would show fairly truly the state of a pregnant woman's thyroid and pituitary activity? Those taken later, however, would need to be discounted by perhaps 10 or 15 per cent due to this physiologic reaction shown by the authors. In other words, the pregnant woman is never in a resting state, and even a normal basal metabolic rate might be the expected finding in a patient actually suffering from thyroid deficiency, and requiring medication. Similarly, a woman showing high basal metabolism readings toward the close of her pregnancy should not be thought to have an overactive thyroid unless other clinical signs of this are present.

DR. FOSTER S. KELLOGG, BOSTON, MASS.—Dr. Ross' figures supply me with an answer to a troublesome question. Why does the South know more about eclampsia than we do? How does Dr. Rucker, not to mention others, see so much eclampsia when it takes our hospital twenty years to get a series of 173 cases? The answer is simple—there is more there to see.

Further, we have sometimes said to ourselves that if the mortality results reported from the Southern institutions are so much better than ours the condition called eclampsia must be milder there. But the terrific general mortality from toxemia as reported by Hamilton, and quoted by Ross, 43 per cent of the puerperal deaths in North Carolina in 1933, shows that this is probably not true. Hence, I must conclude that in the South those toxemic patients with convulsions are being cured by treatment who get to the hospital soon enough. To date we have only lowered our number of deaths from this cause by preconvulsive interference. I have the hope that by adopting your experience we shall do better.

One interesting reason for the discrepancy of the results is brought out in Ross' paper and seems worth comment. He writes that, "We have found urinary infection and essential hypertension in the private patient group more often than in the lower stratum where we have found eclampsia." Our own figures show a maternal mortality of 40 per cent in a known nephropathic (including essential hypertension) group of eclamptics, as against a 10 per cent mortality in a known nonnephropathic group. By implication at least the bulk of these lower stratum eclamptics are what I have called "toxemias of neglect" and elsewhere I have pointed out that toxemias of neglect, treated within a reasonable time, show better results than toxemias developing in spite of good care, which are prone to occur on a hypertension or kidney background.

This paper seems to show that the essence of prevention of eclampsia lies in the timeworn prescription of prenatal care. That it is efficient no one controverts; that its practical application in certain rural communities has not yet been established seems evident. Possibly taxes diverted from the digging of holes and refilling of same to a broad prenatal care program would be profitable.

Our only piece of direct comparison to the results shown in Dr. Ross' paper is this. We selected 80 patients in the clinic upon whom we might try the effect on the blood picture of far better than average diet, including feedings of iron and extra vitamins. Of these 80 patients 17 happened to have come to a preeclamptic or eclamptic end in a previous pregnancy and 7 of them have had eclampsia. Taking the ordinary average of recurrent preeclampsia and eclampsia, we should with only ordinary care have had a certain number develop toxemia, but the result in these 17 patients was that none of them developed any toxemia whatever. It may yet be shown that deficiency diet plays a part in the production of "toxemias of neglect."

DR. M. PIERCE RUCKER, RICHMOND, VA.—Dr. Ross does well to direct our attention to the rôle of diet in the so-called toxemias of pregnancy. It is a complicated subject that needs clarification.

We are told that in Germany during the war, when there was a marked deficiency in food, eclampsia practically disappeared. We are also told that in China, where the mass of people are always on a diet deficient in vitamins and protein, eclampsia occurs not infrequently. Last spring Professor DeSnoo told us that eclampsia was due to excess of sodium chloride. It would be interesting if Dr. Ross can tell us about the salt ingestion of his undernourished North Carolinians.

We have been taught for so many years that we should restrict the diet of a patient with albuminuria and a rising blood pressure, that we starve them almost automatically. It is a question whether it is either wise or even logical. I was particularly interested in the observations that he made in the Salvation Army Home. For years I have been connected with a home for unmarried mothers. Five years ago this home moved from a location near the center of town to a seventy acre farm. There was no change in the personnel of the management. The clientele remained the same. The diet and habits of the girls, however, underwent a marked change. The girls ran the farm, took care of the cows, chickens, pigs, and garden. They had an overabundance of dairy products, eggs, and green vegetables. The dietary before and after the move always contained meat once a day. Since the move there has been only one case of eclampsia, where in the last five years in town there were seven cases. Even more striking has been the change in the incidence of hypertension. In town there was nearly always a "waiting" girl under treatment for this condition. On the farm there is rarely a case.

The close correlation that Dr. Ross finds between the incidence of pellagra and that of the toxemias of pregnancy is interesting. No doubt he would find the same correlation between the presence of pellagra and the absence of prenatal care. We know practically nothing about the cause of eclampsia and preeclampsia. We do know the prodromal symptoms and the preventive treatment, and our empirical treatment has improved wonderfully in the past ten or fifteen years.

DR. E. L. KING, NEW ORLEANS, LA.—Some years ago I found from Italy, Mississippi, and Florida three different papers reporting cases of toxemia with hookworm disease. I then noted the same thing in our Charity Hospital in New Orleans. We found also, that patients with marked anemia as well as hookworm disease, gave us more trouble than those who had hookworm disease alone. In studying the stools we found that 10 per cent of all patients had hookworm disease, while those patients coming from the country must have been from 20 per cent to 25 per cent infested. So that in addition to nutritional deficiencies, the tendency to pellagra, and the low economic status of our patients, there was the complication of the hookworm infestation.

DR. PLASS (closing).—My own interest in hyperventilation arises from my conviction that there is, as a basis for the toxemias of pregnancy, an underlying alkalosis. Obviously this work does not support such a contention. Nevertheless,

such a concept is logical if one takes the view that the symptoms of toxemia are largely the result of efforts on the part of the organism to protect itself. The eclamptic convulsion represents an ideal mechanism for developing an acidosis. When the convulsion begins, respiration stops, and carbon dioxide accumulates in the body. Moreover, the violent muscular contractions with a lack of oxygen lead to the production of relatively large quantities of lactic acid, through the incomplete oxidation of dextrose. The eclamptic convulsion is thus an ideal mechanism for overcoming an alkalosis. A further fact which supports the same idea is that all of the drugs, with the exception of *veratrum viride*, which have been used successfully in the treatment of eclampsia are respiratory poisons. This includes morphine, chloral, magnesium sulphate, and the various barbiturates. Treatment of eclampsia with any of these drugs is not effective unless the respirations are definitely lowered.

DR. ROSS (closing).—We know that our problem is different from that in the East, Midwest and West. Only by careful observation and scrupulous recording can we be of mutual benefit.

Our toxemic group eats an unusual amount of cured or salt pork. It seems paradoxical but the folks living on the farm do not raise their own farm and dairy produce, especially in "good times." The land is used for cash crops and the food brought from stores. During the depression the incidence of eclampsia as well as pellagra was somewhat lower because the farmers had to be self-sustaining.

### THE FRANK-GEIST OPERATION FOR CONGENITAL ABSENCE OF VAGINA\*

WALTER T. DANNREUTHER, M.D., F.A.C.S., NEW YORK, N. Y.

VARIOUS operative procedures have been devised for the construction of a vaginal canal in females whose external genitals are otherwise normal. Surgical interference is justified in a young, attractive girl with obvious secondary sex characteristics and sex urge; in a patient who is contemplating marriage and who understands the existing anomaly; in a married woman who finds it impossible to fulfill her marital obligations; and for the relief of hematometra when there is vaginal aplasia.

Two distinct types of defect come under observation: first, a gynatresia which results from birth trauma; and second, congenital aplasia of the vagina which, as a rule, is associated with absence or rudimentary development of the uterus. In most of the latter group there are normal external genitals, tubes, and ovaries, but complete absence of the uterus and vagina. In these individuals it is evident that during the embryonal period, there was no union of the Müllerian ducts and no formation of the uterovaginal canal.

The first attempts to establish a vaginal canal in such cases consisted of making an opening in the cellular tissue between the bladder

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and rectum and inserting some form of tampon to maintain its patency. Dupuytren apparently operated upon the first patient in 1817. These early operations were obviously doomed to failure, although Kanter<sup>1</sup> reported a somewhat similar operation in 1935 in an individual who had a partial atresia of the vaginal canal. The treatment consisted solely of repeated dilatations and packing, and two years afterward the vagina was patent and well epithelized from the introitus to the cervix, although abnormally narrow. Kanter's patient had a preoperative vaginal opening which almost admitted the tip of the examining finger for a distance of one inch, as well as a double uterus with normal Fallopian tubes and ovaries, so that the satisfactory end result does not justify the deliberate selection of this method of treatment for congenitally aplastic cases.

More extensive operations which involved the taking of strips of mucocutaneous and cutaneous tissue from the labia, vulva, and inner aspect of the thighs, introducing them into a canal previously made between the rectum and bladder, and packing them in position with gauze, was the second advance made in technique.

Beck<sup>2</sup> utilized these fundamental principles in developing the details of his operation as early as 1900. He made a transverse incision immediately above the symphysis pubis, which was carried downward between the peritoneum and bladder, hugging the bladder closely until the space between the bladder and rectum was reached. A counteropening from the perineum was then made to meet the passage already created, to establish a continuous canal from above the perineum to above the pubis, but without any opening into the peritoneal cavity. Two skin flaps were dissected from the thighs, their bases being represented by the labia and their length being sufficient to reach through the extent of the newly formed canal. These flaps were seized with forceps introduced from above, drawn through the canal and sutured at the upper end. The suprapubic wound was then closed. Bumm and Puppel both split the labia minora, and tried to create a vaginal lining with these mobilized tissues, but contracture followed.

Graves<sup>3</sup> developed a much better method of transplanting flaps from the labia and thigh. After incising the occluded tissue at the vaginal orifice and separating the bladder and rectum, the two labia minora are dissected off from above downward in such a manner as to leave a pedicle sufficiently large to furnish good circulation. The two surfaces are then split apart so that two paddle-shaped flaps remain. Two similar flaps, which have their bases at the two lower corners of the artificial opening, are dissected from the inner side of the thigh. All four flaps are then sutured together over a glass form, after placing several catgut sutures with the ends left long in the vault of the artificial cavity. When the skin pouch has been nearly completed, the glass form is removed and the catgut sutures are brought out through the skin pouch. The pouch is then inverted and the sutures are tied so that the transplanted flaps fit snugly into the artificial cavity.

Mackenrodt<sup>4</sup> suggested covering the surface of the newly opened vaginal canal by transplants of mucous membrane from another patient, but the futility of using isografts is now well recognized.

Sneguireff<sup>5</sup> was apparently the first one to utilize a portion of the rectum for the formation of a new vagina. His operation consisted of making an incision along the border of the lower portion of the sacrum and coccyx, resecting the



coecyx, and separating the rectum from the anterior surface of the sacrum. After stripping the gut from its surroundings, it was drawn into the incision, ligated in two places and cut. The superior portion was separated from the bladder, drawn down to the base and sutured. This superior segment of the rectum was found surrounded by some fibers of the levator ani, which were secured with it to act as a third anal sphincter. The inferior segment was brought down and its upper end closed by sutures, thus forming a culdesac or cavity to serve as the new vagina. A secondary operation was done to establish the vaginal opening fourteen days later. This consisted of making an incision through the fibrous ring situated between the anus and the lower border of the urethra, uniting the rectal mucous membrane to the adjacent parts and transforming the circular opening into a longitudinal one. The description of this operation in the original article is somewhat hazy and just what was done with the anus in this case is not clear from either the text or the illustrations which accompany it. This very early case of Sneguireff's probably served as the basis for the technique proposed by Popow<sup>6</sup> and which he described in 1910 and had carried out in 5 cases prior to 1914. This was further elaborated upon by Schubert<sup>7</sup> in 1911.

For many years the most popular and successful operation for the formation of an artificial vagina was that proposed by Baldwin<sup>8</sup> in 1904, and it is interesting to note that the case which gave Baldwin his concept of the technique which he later perfected occurred in a patient who did not have a congenitally absent vagina, but who had had a sloughing of the entire vagina and cervix following delivery at term by instruments and after craniotomy. Unfortunately this woman refused operation.

Baldwin<sup>9</sup> did not perform his first operation until March, 1907, when he did it on a woman of thirty-eight years whose vagina had also sloughed out as the result of birth trauma. The Baldwin operation in the hands of most abdominal surgeons, including its originator, has carried with it a 6 to 17 per cent operative mortality. Its most enthusiastic advocates at the present time are Judin,<sup>10</sup> who reported 6 successful cases in 1927, and Masson,<sup>11</sup> who reported 5 successful cases in 1932, all 11 cases having been done without a fatality. Briefly the operation consists of the following steps:

1. Dissection of a canal in the soft tissue between the bladder and rectum up to the peritoneum, which is tightly packed with gauze.
2. Resection of a loop in the lower part of the ileum about 25 cm. long with mesentery sufficient to allow it to reach to the perineum.
3. Side-to-side anastomosis to re-establish the continuity of the intestinal lumen.
4. Closure by purse-string suture of the ends of the detached section.
5. Drawing down of the lower point of the loop into the excavation made between the bladder and rectum. (To insure adequate blood supply it is advisable to leave large vessels at each end of the resected loop rather than a single one in the middle where the tension is greatest.)
6. Closure of the abdominal wound.
7. Opening of the presenting loop of bowel in the perineal wound and stitching to the skin of the vulva by interrupted silk sutures.
8. Repacking of the bowel with sterile gauze.
9. Destruction of the septum between the two sections of bowel two weeks later by application of forceps.

Although his ideas had been antedated by Menge, Schubert described an operation in 1911 and again in 1923 which consisted of resection of the lower segment of the rectum with its transplantation into the space created for a new vaginal canal and fixation of the lower end of the upper rectal segment to the ring of the anal sphincters. The chief disadvantage of this operation is its predisposition to local infection and sepsis and, like the Baldwin, its relatively high operative mortality. The Popow-Schubert operation consists of a retroperitoneal resection, appropriating the lower 12 cm. of the rectum for the vagina, and drawing down the upper part of the rectum through the sphincter muscles and attaching it to the anal skin.

In 1927 Frank and Geist<sup>12</sup> published their "satchel-handle" operation, so-called because of the construction of a pedicle tube graft from the inner aspect of the thigh to secure tissue for lining the new vaginal canal. They outlined their technique for the various surgical steps, and reported one case in which the operation had been performed with a satisfactory result. In a second publication in 1932 the same authors<sup>13</sup> referred to their original patient and reported three additional cases. They have now done the operation nine times.<sup>14</sup> In 1932 Grad<sup>15</sup> described a modification of the Frank-Geist operation with its application to one patient. Instead of using a tube graft, Grad made a skin graft from the thigh measuring 17 cm. long and 12 cm. across, with two curves at the distal end; the incision is carried to the full depth of the skin and the flap is then undermined to the extent of about one inch; after it is undermined the skin is sutured back to its original position and several days later the original incision is reopened and the flap is undermined throughout its full length and breadth except at its base near the vulva. The further mobilized flap is again sutured back to its original position and allowed to heal. After all soreness has disappeared and the tissue regains its normal appearance, the entire skin flap is loosened except at its base. The vaginal tube is then constructed from the skin flap with its surface inside. This is tucked into the pelvis between the bladder and rectum. A few days later the skin flap is gradually severed from the vaginal orifice, the base of the flap replaced in its original position, and the rest of the granulating surface repaired with Thiersch grafts.

#### CASE REPORTS

The first of three patients, R. K., with congenital aplasia of the vagina (Fig. 1) came under my observation in 1928. She was an asthenic, unattractive female of thirty-four years, devoid of secondary sex characteristics and without interest in the opposite sex, although the urethra was greatly dilated. There was no indication for the correction of the developmental defect in this woman.

The second patient, R. F., aged twenty, with well-marked secondary sex characteristics and who was contemplating marriage, also presented herself in 1928 and was referred to Drs. Frank and Geist for operation. All experienced pelvic surgeons appreciate the difficulties involved in a secondary plastic operation, such as the repair of a vesicovaginal fistula or a third-degree perineal laceration, after previous attempts at correction have been made by inexperienced operators and resulted in failure. I therefore deemed it desirable to see the technique carried out in all its details, and to familiarize myself with the practical points in the daily care and treatment before undertaking one of these operations personally. Having had these advantages, I felt justified in assuming full responsibility for the third patient, who presented herself in 1936. This was a girl of nineteen, who had well-developed secondary sex characteristics, estrin in her blood, a strong sex urge, and was engaged to be married, although she had never menstruated. Abdominal cramps, backache, and headache had occurred at monthly intervals since the age

of twelve. She had previously consulted five other physicians because of the amenorrhea; two of them had subjected her to anesthesia and some sort of a minor operative procedure, the nature of which could not be ascertained.

My purposes in making this presentation are: first, to record the operation in the literature under the names of its originators, so that Drs. Frank and Geist may receive the credit which is due them. The term "satchel-handle" operation is picturesque, but fails to identify

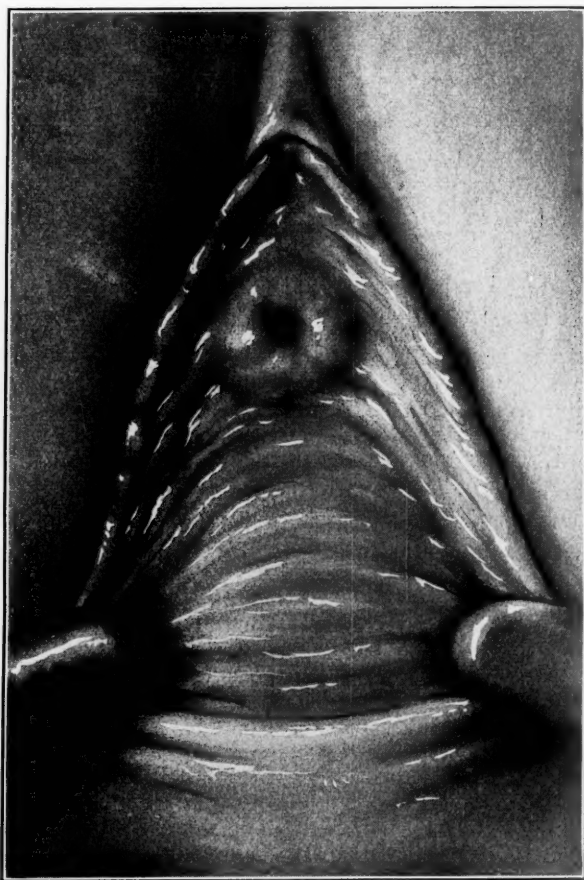


Fig. 1.—The usual appearance of the vulva in cases of congenital vaginal aplasia.

the technique with its proper name. Second, as the operation is now done, it differs slightly in detail from its original description. Third, the refinements of the daily treatment of the patient are of the utmost importance and may well be emphasized; and, fourth, a series of illustrations may clarify the technique for some one else who plans to do a Frank-Geist operation. I am indebted to Dr. Samuel H. Geist for his personal advice, which was courteously given from time to time as the several steps of the operation were carried out.

## PROCEDURE

The Frank-Geist technique includes three distinct operative steps, with occasional interspersed minor procedures, numerous dressings and meticulous attention to detail. The operative field should always be thoroughly scrubbed with green soap and water, but strong antiseptic solutions should be omitted. The first operation consists of making a skin flap on the inner aspect of the thigh six and one-half inches long and three inches wide (Fig. 2) and converting it into a pedicle tube. The parallel incisions are not carried down to the fascia lata, as originally suggested, but only sufficiently far to leave a small amount of subcutaneous fat on the undersurface of the flap. The pedicles are slightly flared at each end and care

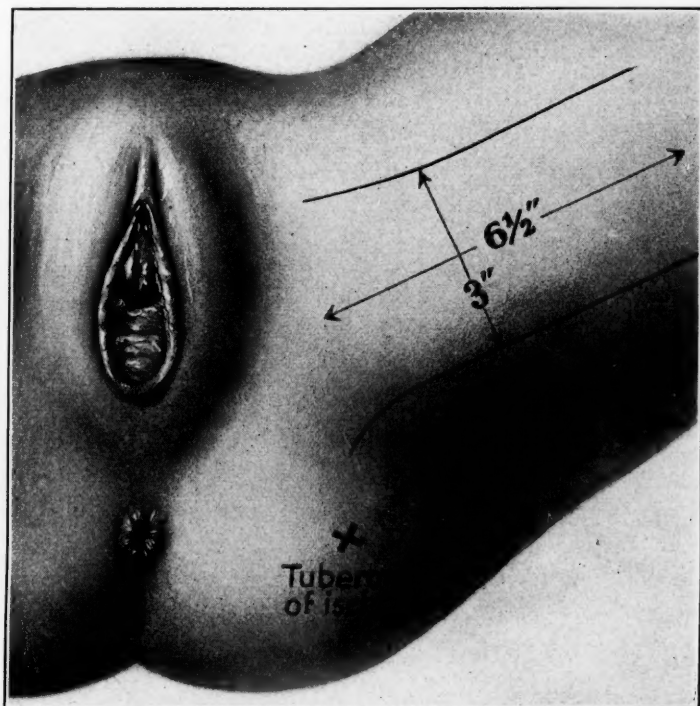


Fig. 2.—Outlining the margins of the skin flap on the inner aspect of the thigh.

must be exercised to avoid bringing the margins of the proximal pedicle too close to the tuberosity of the ischium, which might eventuate in a painful cicatrix on sitting, or too near the groin, which would limit the undermining of attached skin by the proximity of the dissection to the saphenous vessels (Fig. 3). After the fat left on the undersurface of the flap has been evenly trimmed, the tube is made by uniting the two cut edges with interrupted silk sutures. The skin of the thigh on each side is then undermined for an inch or two and, after delicately ligating all bleeding points, the mobilized skin edges are slid together beneath the tube and approximated with interrupted silk sutures. Three or four silkworm-gut retention sutures, secured at each end with small lead squares and perforated shot, serve to minimize the stress on the line of union (Fig. 4). A little fat is necessarily left exposed at the ends of the pedicle. A small sheet of rubber tissue in-

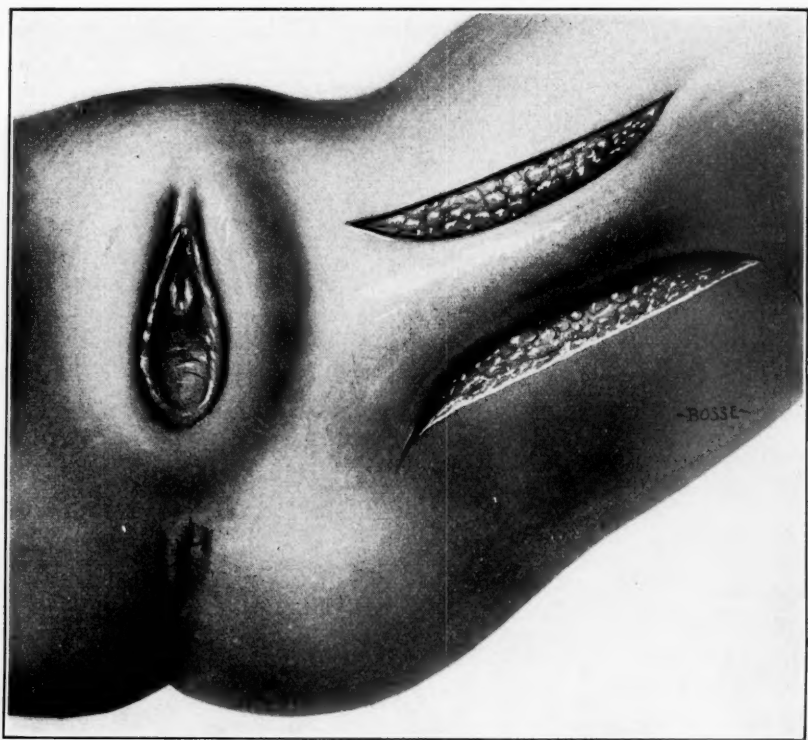


Fig. 3.—First step in the construction of the tube flap.

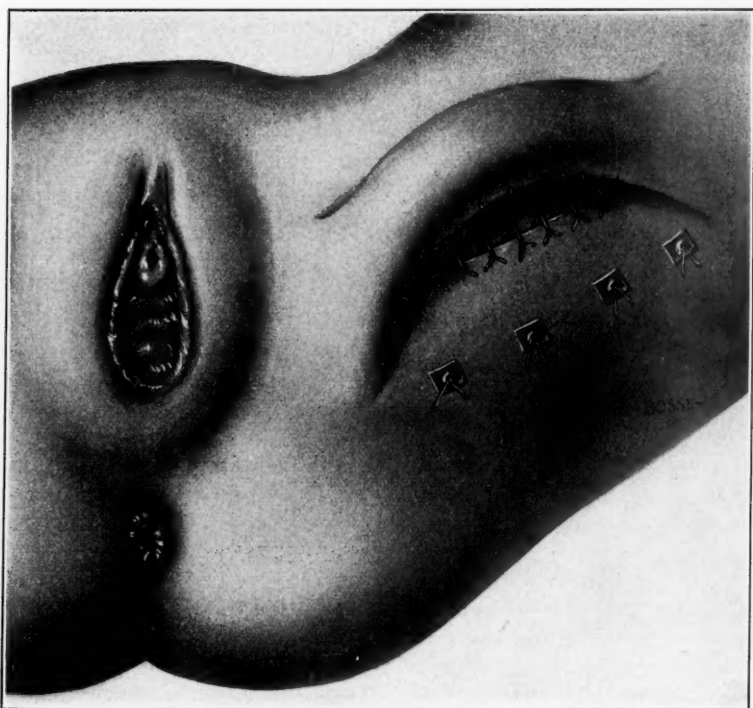


Fig. 4.—The margins of the flap have been united with interrupted silk sutures and the skin edges approximated beneath the tube.



served between the tube and underlying united skin edges separates the opposed lines of union and protects the raw areas. A gauze bolster is placed on each side of the tube and the whole operative field covered with a light dressing. For several days the discharge from the exposed area is quite free, requiring frequent changes of dressings. The sutures are removed after ten days and a day or two later the patient is allowed up in a wheel chair. Daily dustings with thymol iodide help to keep the wound clean and dry. After three weeks the distal attachment of the tube flap is incised slightly on each side, under gas or local anesthesia. The detachment is carried further a few days later, thus leaving only a small area of attachment in the center (Fig. 5).

The second operation is done about four weeks after the first. The narrow remaining attachment of the distal extremity of the flap is completely severed

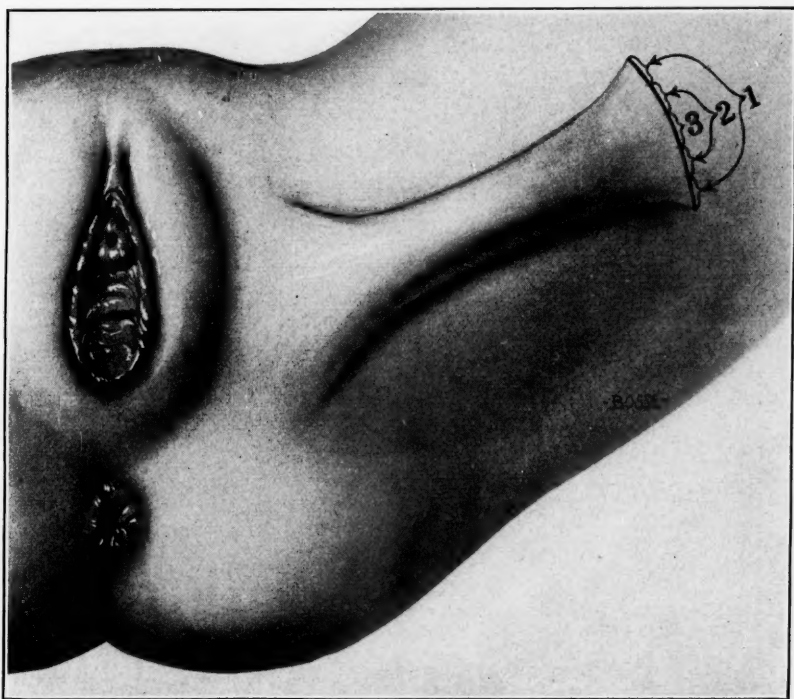


Fig. 5.—Showing the method of mobilizing the distal attachment of the tube flap by progressive incisions.

(Fig. 6) and the line of union on the undersurface of the tube reopened throughout its entire length. After trimming the scar tissue from the cut edges, the flap is temporarily wrapped in a large gauze pad, wrung out in hot saline solution. The tissue partition occluding the vaginal space is incised transversely (Fig. 7) and two of the operator's fingers are insinuated between the bladder and rectum up to the peritoneal reflection (Fig. 8). This blunt dissection is surprisingly easy, provided the proper line of cleavage has been entered. The incidental bleeding is quite free, however, because the vaginal venous plexus is necessarily traumatized and one or two ligatures may be required. The vaginal space is then stuffed with gauze until the preparation of the flap for insertion has been completed. The proximal attachment of the flap is still further mobilized and lengthened by two

curved incisions which bring its base closer to the labia. It is then inverted so that the skin surface is inside and draped over a hard-rubber vaginal plug of appropriate size, through the top of which a small hole has been drilled (Fig. 9, *A*). The lateral margins of the flap are fastened together with three plain catgut sutures and, after proper disposition of the tissue over the plug so that the pressure is everywhere equalized, the apex of the transplant and the hole in the plug are transfixed with a long straight needle carrying a silk thread; one end of the thread is brought through the lumen of the plug, the other left on the outside of the flap, and the two ends tied at the margin of the plug, thus firmly fixing the apex of the flap (Fig. 9, *B*). The pedicle is rotated 180° toward the vaginal introitus and the

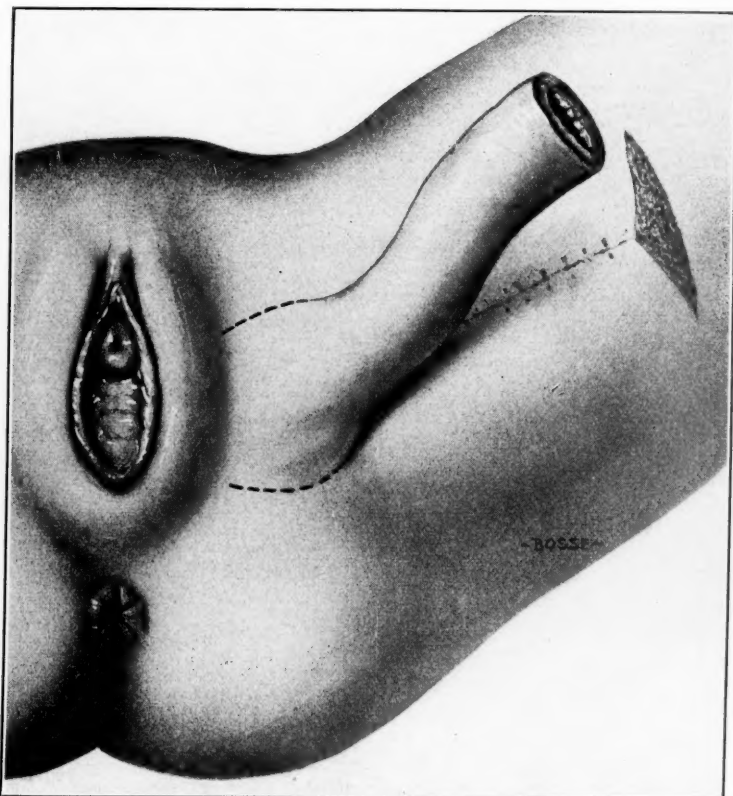


Fig. 6.—The distal flap attachment completely severed.

flap-covered plug inserted into the newly created vesicorectal space (Fig. 10). Three or four interrupted sutures fix the free end of the flap to the vaginal orifice. No attempt is made to repair the denuded area at the base of the lengthened flap. A Pezzer self-retaining catheter is introduced into the bladder and left for eight days. Continuous pressure on the vaginal plug is maintained by means of an overlying rubber sponge and a tight T binder. The diet is restricted to fluids. Small doses of paregoric are given for a day or two and the bowels are not allowed to move for eight days, although a rectal tube may be used to relieve accumulations of gas. The catheter is irrigated daily with warm boric acid solution. Discharge from the denuded area on the buttock, the vaginal canal, and the lumen of the plug may be

free and somewhat offensive for the first few days, but this is easily controlled with gentle potassium permanganate irrigations. Scrupulous cleanliness and frequent change of dressings are essential. After eight days the catheter is removed, the silk thread holding the flap on the plug is cut and withdrawn, and the bowels are allowed to move. At the end of two weeks the new lining of the vaginal canal is found tightly adherent to adjacent tissues, so that the vaginal plug can be removed and replaced at the patient's convenience. By the end of the third week, when the entire field is dry, the detachment of the flap from the covered margin of the vaginal canal can be started. It is severed little by little, as in the case of the distal extremity.

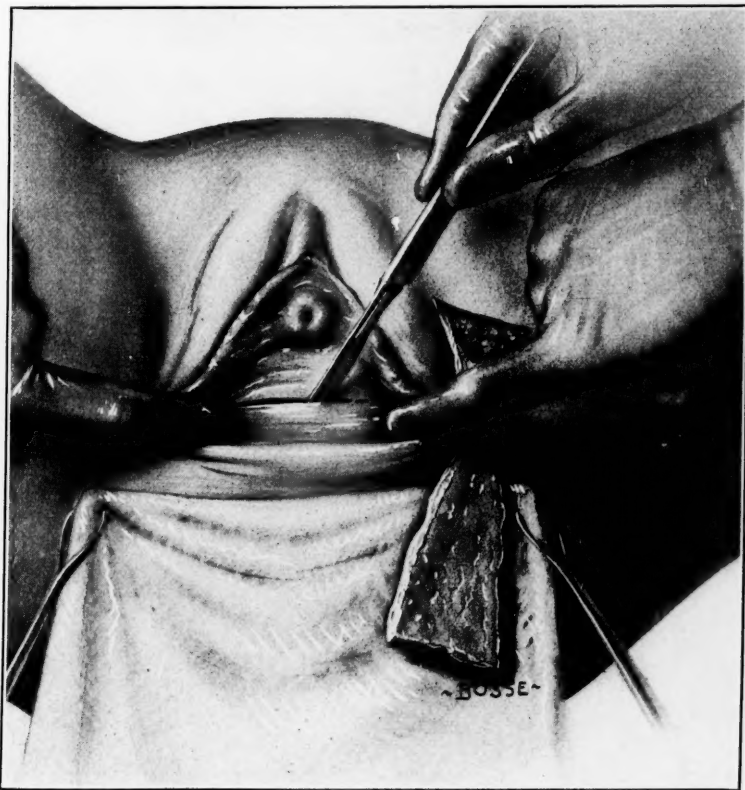


Fig. 7.—The tube flap opened and the incision through the occluding vaginal partition.

The third operation consists of completing the detachment of the flap at the vaginal orifice, freshening the granulating area and skin margins at the base of the flap, introducing a few more catgut sutures at the introitus and replacing the severed tongue of skin flap in the bed from which it originated (Fig. 11). It is wise to provide through and through drainage for a few days by means of a small rubber tube, to prevent the organization of a subcutaneous hematoma. Silk sutures are used for fixation of the replaced tissue. Although the patient can be discharged from the hospital two weeks later, the vaginal plug is, of course, worn continuously for several weeks thereafter.

The sooner the patient marries the better. Coitus is the best available method of dilatation to insure the patency of the new vaginal canal. A vaginal dilator should

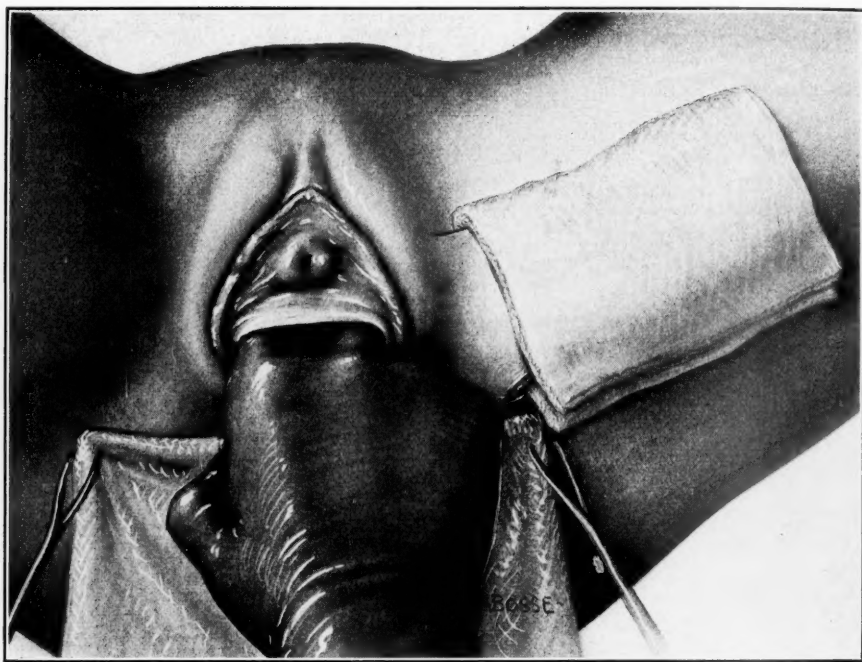


Fig. 8.—The flap is wrapped in a wet gauze pad while the vaginal dissection is carried out.

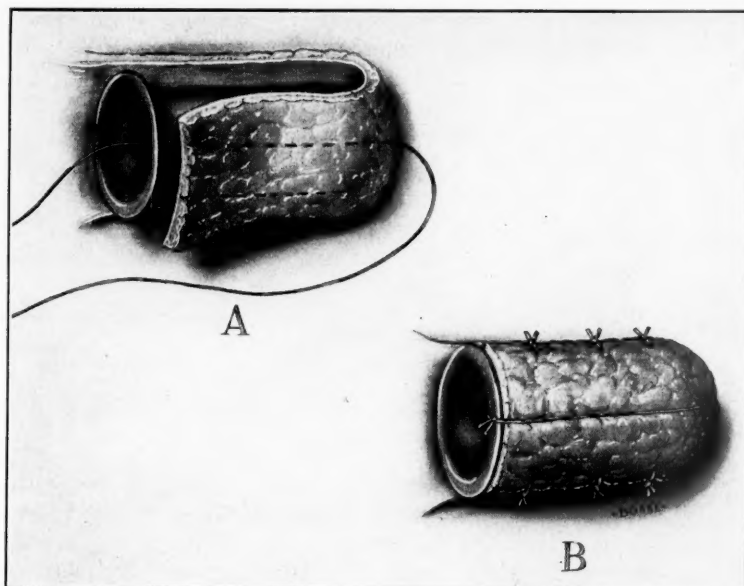


Fig. 9.—A, The flap is draped over a hard-rubber vaginal plug and fixed with a transfixion silk suture. B, The lateral margins of the flap are fastened with interrupted catgut sutures.

be passed every day during the next year to prevent contraction and, if the patient does not marry, the vaginal plug should be worn every night.

The patient on whom I operated was a very attractive, youthful-appearing, young woman with a typical feminine body contour, well-developed breasts, and pronounced secondary sex characteristics. With the patient in repose in lithotomy position, the vulva looked normal, but on separating the labia the external urinary meatus looked larger than normal and the vestibule below the lower margin of the meatus seemed unduly short. The fourchet appeared normal, but there was no evidence of a vaginal orifice or a hymen, the tissues being gradually fused by an occluding mucous membrane partition. This septum could be considerably indented with the tip of a probe.

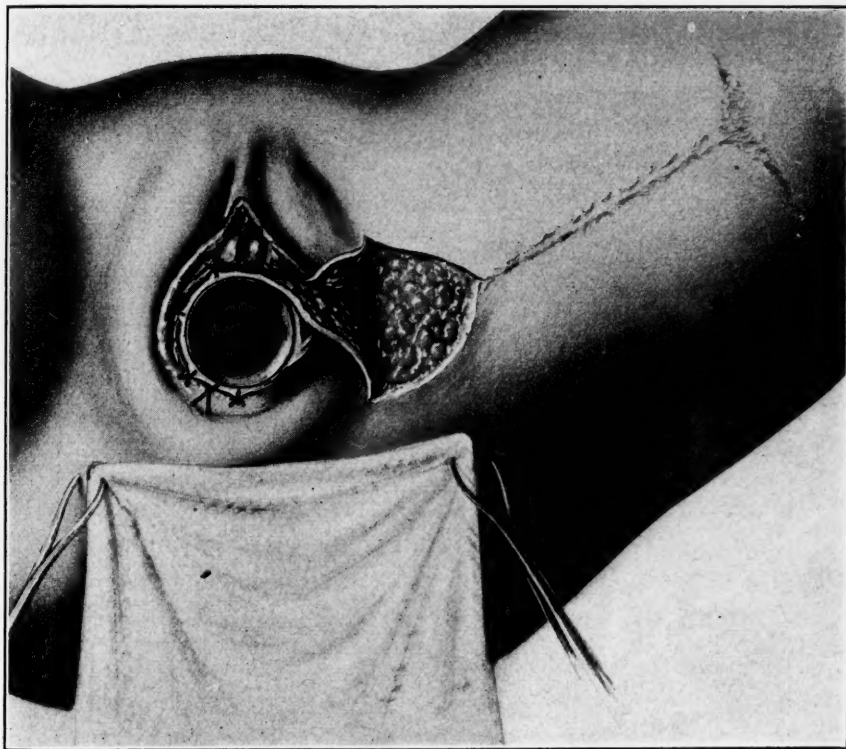


Fig. 10.—The flap-covered plug inserted into the rectovaginal space with a few sutures at the margin of the vaginal orifice.

The patient entered the New York Post-Graduate Hospital on Dec. 14, 1936, and the first stage operation was done the next day. The tube flap healed kindly, but a bacillus pyocyaneus infection appeared in the skin wound on the sixth day which interfered with primary union and delayed the incision of the distal end of the flap for several days. All sutures were removed on the fourteenth day. Incandescent light treatments were given daily until the twenty-first day when the small incisions at the distal extremity of the tube flap were started. Additional snips were made during the next week, the distal end being completely severed and the second stage operation performed on the twenty-eighth day. Immediately thereafter the bladder was drained with a self-retaining catheter and the bowels constipated with paregoric for eight days. Although Dr. Geist had cautioned me



that I might expect the development of a cystitis and pyelitis during this time, neither complication appeared. Perhaps the prophylactic use of hexamethylenamin and acid sodium phosphate prevented them. On the forty-sixth day, the sutures in the right margin of the vaginal canal were removed and the incisions in the proximal end of the flap started close to the vaginal orifice. The new vaginal canal easily accepted two fingers, and the flap was firmly united to the underlying tissues. A larger vaginal plug than the one previously used was inserted into the canal.

The proximal attachment was completely severed on the fifty-third day and sutured to the margin of the introitus, thus completing the lumen of the new vagina. The proximal pedicle was used to cover the granulating area from which the base of the flap had been taken. Despite careful hemostasis a small clot formed under this flap interfering with immediate union, so that it was necessary to dislodge the

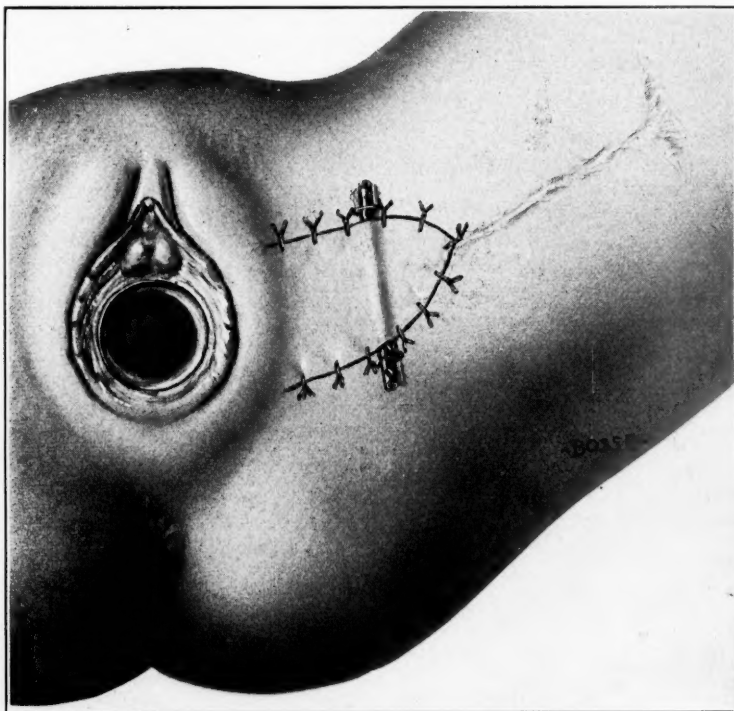


Fig. 11.—Resuture of the proximal pedicle of the skin flap back in its original position. The small rubber tube drain is good insurance against the formation of a subcutaneous hematoma.

clot by irrigation eight days later and insert a tiny through-and-through drainage tube. It would, therefore, seem wise to insert a similar tube at the time of the third stage operation to preclude such a clot organization. The patient was discharged from the hospital on the seventy-first day (ten weeks after admission) and instructed to wear the vaginal plug every night. She is now happily married.

The comparative utility of the four basic methods for colpoplastic construction may be briefly evaluated as shown in Table I.

The Frank-Geist operation confines the patient to the hospital for about ten weeks and imposes a responsibility on her as well as on the surgeon. The prolonged hospitalization and the constant cooperation

TABLE I

OPERATION	ADVANTAGES	DISADVANTAGES
Baldwin	Flexible, elastic vaginal tube.	Intraperitoneal technic. High mortality rate. Profuse irritating mucous secretion.
Popow-Schubert	Retroperitoneal technic. Mucous membrane vaginal lining.	Varying degrees of rectal incontinence. Frequent intestinal fistulae. Occasional sepsis.
Graves	Extraperitoneal technic. Can be done in one stage. Short hospitalization.	Mutilation of vulva. In event of flap necrosis, there is no tissue available for second attempt. Possible growth of hair in vaginal canal. Subsequent scarring and contraction.
Frank-Geist	Extraperitoneal technic. No mortality. Well-mobilized flap, devoid of hair. If operation fails, tissue from opposite thigh is available.	Prolonged hospitalization.

which may tax her patience are just as essential as the faithful attention to detail by the operator. The chief advantages of the procedure are its assurance of a serviceable vagina and its freedom from mortality.

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## DISCUSSION

DR. JOE V. MEIGS, BOSTON, MASS.—Dr. Dannreuther's advocacy of the use of plastic surgery from below instead of intestinal surgery from above is sensible. I believe that the use of a method that involves resection of any part of the intestine should only be undertaken by those surgeons who are doing considerable intestinal surgery, and not by those of us who are unused to it.

I should think by using one leg only, as Dr. Dannreuther has described the operation, it would be necessary to take too much skin from that one member. A few years ago Dr. Stephen Rushmore of Boston, in the September, 1929, number of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, presented a method of similar type. He formed tube grafts on both legs, and then before inserting them split the grafts open and sutured them to one another and thus obtained a very good sized vaginal canal.

Lately I have had a patient under supervision upon whom, I have done the operation that Dr. Dannreuther attributes to Graves. It involves the using of the labia minora to form the upper part of the vagina and two strips from the buttocks to form the posterior wall. This made a vagina but two inches deep and was not satisfactory.

Dr. M. N. Smith-Petersen found some time ago that Pyrex glass embedded in tissue caused a smooth glistening membrane to form around it and that the cavity contained fluid. From this he has gone on to construct cups that are placed between the head of the femur and the acetabulum in reconstructing hip joints that have been fused. On removal of the cup after a year he has found a smooth glistening membrane that contains clear fluid. Thus the hip joint is repaired.

It occurred to me that if the tissue between the rectum and the bladder, and the urethra and the retroperitoneal tissues could be easily separated, as they can be, in cases with congenital absence of the vagina, that it might be valuable to insert a Pyrex glass phallus and leave it for six months to a year to obtain a smooth cavity. At the end of that time the Graves method of grafting labia and skin up to the newly formed cavity would be used. In one case it was necessary to place the glass apparatus after the skin graft as it had already been done. So far it has been successful but there has been difficulty in holding the glass in place and preventing infection around it. I believe that by burying the glass in the soft tissues and leaving it there a successful cavity could be made and from it, after skin grafting of a minor degree, a satisfactory vagina.

DR. FRANCIS W. SOVAK, NEW YORK CITY (BY INVITATION).—In considering operations for the correction of congenital aplasia of the vagina, we have always been confronted with the problem: Do the end results justify the risk involved? The Baldwin and the Schubert operations carry with them the grave possibility of peritonitis or intestinal fistula and are only successful when performed by a very few expert operators. The Frank-Geist operation, however, apparently obviates these risks and insures a successful outcome when meticulous preoperative preparation, detailed attention to the various steps of the operation, and diligent postoperative care are carried out.

I am thoroughly in accord with Dr. Dannreuther's statement that no operation for the correction of aplasia of the vagina should be undertaken unless a woman has well-developed, secondary sex characteristics, evidence of estrin in the blood, a normal sex urge, and is contemplating marriage.

I would like to mention here what I believe to be a most important reason for performing these operations, and one, too often overlooked by surgeons who contemplate operations on the reproductive organs, namely the beneficial psychologic effect which the correction of such an anomaly has upon a woman who feels she is abnormal. Such a woman will readily submit to operation, and in fact will even plead for operative interference if she believes it will make her nearly as normal as her sisters. Unquestionably a woman who has been afforded a normal outlet for her sex drive, and also an opportunity for wifehood, will show a markedly uplifted mental attitude.

DR. NATHAN P. SEARS, SYRACUSE, N. Y.—I have had within the last year two cases of congenital absence of the vagina, which after careful study of their endocrines seemed to be fitted for reconstruction operation.

In regard to the technic, I am glad that it is not deemed necessary to take such a large pad of fat, because the thickness of this pad may interfere through pressure with the circulation of the skin. This was evidenced in one of my patients during the making of the tube flap so that I modified the operation by unfolding

the tube and sewing the flap back in its original bed. This modification worked very well, and when it was later placed in the space between the bladder and rectum, it was in a very healthy state.

My second case brought out a point which is very interesting in the light of what Dr. Meigs has said. The patient had had a former attempt in another city to reconstruct the vagina. Thiersch grafts had been used but the canal had contracted to an irregular channel not over 2 or 3 mm. in diameter. Two hours and forty minutes were consumed at one stage of my operation in removing scar tissue and dilating opening at canal. The usual tube flap was placed in the bed but on removing the plug later, practically the entire graft came out. She then wore a glass plug for several months and now has a perfectly normal vaginal canal more than 4 inches in depth. The question is, Did some of the Thiersch grafts remain, did some of my own tube graft remain, or by using the glass plug did this vaginal cavity develop a soft, glistening lining? What Dr. Meigs has said, together with this experience makes one wonder whether or not it is necessary to put the patient through the many and tedious stages of a tubular graft operation in order to create a vaginal canal.

DR. VIRGIL S. COUNSELLER, ROCHESTER, MINN.—Construction of a new vagina must be done by one of two procedures, either by using a portion of the intestinal tract or by using pedicle skin flaps. The Baldwin operation which utilizes the small intestine is not unusually difficult but is associated with a rather high mortality. If the mesentery of the ileum is short, as is often the case in congenital absence of the vagina, the ileum cannot be brought down into the vaginal position without considerable tension. If the mesentery is under tension the vessels will undergo thrombosis which will cause the implanted intestine to slough.

If pedicle flaps are used in the reconstruction, several operative procedures are necessary; these necessitate repeated and prolonged hospitalization. Unless one is particularly skilled in the use of pedicle grafts, failure is likely to ensue.

I would like to present a new operation for congenital absence of the vagina, which I have developed following the suggestion of Gilles and McIndoe of London. In this operation an inlaying graft is used. Their experience in constructing the external auditory canal, the nasal channel, and the male urethra by this same principle suggested the construction of an artificial vagina. The success in other conditions seems to be attributed to maintaining the channel by a tube or splint for four to six months until the period of contraction has passed, when the splint can be removed and the tract will remain in a normal state.

The procedure consists in obtaining the correct cleavage plane between the bladder and the rectum. Care should be used to keep adequately away from the urethra and bladder, which safeguards against injury of these structures. A rubber tube which conforms to the depth and diameter of the vagina is then selected. This tube is covered with a mastic solution for the purpose of holding the graft in position for ten to fourteen days. A split Thiersch graft which is large enough to cover the rubber tube is then obtained from the inner aspect of the thigh. This is carefully placed in the site of the new vagina and held in position by an obturator placed in the open end of the tube. The tube is removed on the tenth or twelfth day, at which time the new tract is completely covered with a thin layer of epithelium. The tract, which now resembles a normal vagina without a cervix, is cleansed with warm irrigating solution. The rubber tube at this time is replaced by a solid splint which completely distends the vagina. The splint, which is held in position by a sanitary belt, is worn constantly for four to six months and is removed by the patient once a day when the vagina is to be cleansed. After the contraction period has safely passed, the splint is removed and the vagina, which appears as a normal one, will remain as such.

The operation is simple, the period of hospitalization lasts two to three weeks, and the surgical risk is practically zero when usual surgical precautions are used.

DR. W. WAYNE, BABCOCK, PHILADELPHIA, PA.—I did a similar operation to that mentioned by Dr. Counseller before the Clinical Congress of Surgeons held in Philadelphia last year. A thin quadrilateral skin graft was taken from the girl's thigh and sewed inside out with very fine wire over a test tube of appropriate size. This was introduced into a pocket readily formed between the rectum and bladder and the test tube held in place with wire sutures. At the end of about a week the test tube was withdrawn and the graft found to have entirely healed in place, leaving a canal lined with skin. The patient was discharged about a week later, with instructions to introduce daily a well-lubricated test tube of appropriate size. The result seems to be entirely satisfactory. The method is but a modification of the Esser inlay graft and a properly modeled stent of dental modeling compound may be used and buried by suture with the ensheathing graft for a week or ten days. I certainly can commend this operation as being very simple and very effective.

DR. DANNREUTHER (CLOSING).—I disagree with the statement that we see few of these cases of congenital absence of the vagina, but I can agree that we see very few that are suitable for operation. I have seen two additional patients since the one operated upon last year, but they were not interested in future marriage, had no secondary sex characteristics or estrin in the blood, and there was no indication for any type of surgical intervention.

The chief objection to the Graves operation is that the vulva is mutilated. I deem it advisable to preserve all of the attractive features of these young women. In the second place, the Graves operation utilizes a graft from both thighs which leaves no available tissue in the event of a failure, whereas in the case of the Frank-Geist operation it is still possible to reperform the operation by taking a flap from the remaining side.

Satisfactory heavy glass vaginal plugs in sets of six sizes can be secured from the Kny-Scheerer Company in New York. The rubber plug which is utilized in the Frank-Geist operation at first, for the purpose of transfixing the apex of the flap, is necessary because it is difficult to drill a hole through glass without breaking it. As soon as the flap becomes firmly adherent, glass plugs can be substituted. I think it is desirable to have the patient insert the plug every night, rather than to wear it continuously.

I also believe that it is wise to defer operation until just prior to the patient's marriage, because no artificial dilator will do what coitus can accomplish. When my patient was examined by my colleagues immediately after operation, they feared that the new canal would contract, but on reexamination four months after marriage they agreed that the vagina is now normal in its capacity.



## CESAREAN SECTION IN INFECTED CASES\*

WILLARD R. COOKE, B.A., M.D., GALVESTON, TEXAS

ONE of the all-too-familiar problems of obstetrics lies in the previously mishandled case in which cesarean section, contraindicated by infection, is the only alternative to a destructive operation upon a living fetus or a probably fatal attempt at its operative delivery. Each of the procedures which have been devised in the attempt to solve this problem (Porro, Küstner, Latzko, Hirst, Portes, pubiotomy with or without vaginal hysterotomy, etc.) has its peculiar difficulties, disadvantages, and dangers: which are so well known as to require no comment here. This paper is the account of another attempt to effect a solution of the problem.

Since peritonitis is by far the most frequent cause of death following section in infected cases, the first attempt was made in the direction of providing ample room for the delivery of a large fetus through a completely extraperitoneal operation. The greatest defect of previous extraperitoneal operations lies in the fact that the uterine incision, necessarily inadequate on account of the limited working space, may extend by tearing during the delivery of the head, with possible damage to large vessels, bladder, or ureter, or rupture of the peritoneum (which of course defeats the principal object of the operation). This first operation consisted of a modification of the Latzko principle: through a midline incision, the peritoneum was separated from the upper and posterior surfaces of the bladder and from the anterior wall of the uterus to the uterovesical reflection. Next, the anterior and posterior leaves of the broad ligaments were separated to a point above the uterovesical reflection on each side. This step permitted the making of a U-shaped incision in the uterus large enough to furnish an opening adequate to the delivery of the head without danger of tearing the peritoneum. The vertical wings of the incision lay a little mesial and anterior to the main ascending uterine vessels. While ample room is thus obtainable, the operation is difficult and tedious on account of the necessity for tying many transverse arteries and large veins as each vertical incision is made. The operation was performed only once, with no complications except a pelvic cellulitis with an abscess which required drainage by anterior colpotomy. The ultimate outcome of the case is not known, as the patient was not seen again after making an apparently complete immediate recovery.

As this first operation proved so formidable, and was not entirely free from the dangers inherent in other extraperitoneal operations, the second experiment was made in the direction of combining a transperitoneal

\*Read at the Fiftieth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, Hot Springs, Va., Sept. 20 to 22, 1937.

operation with an attempt to restrict any consequent peritonitis to a limited area. To this end, the Hirst principle was adopted: i.e., the suture of the uterine to the contiguous parietal peritoneum around the projected uterine incision, in such a way as to eliminate the objectionable features of the Hirst operation, which are:

1. It is not applicable to the low type of section.
2. In order to provide room for the delivery of even a normal head, each side of the elliptical suture line must be at least 18 to 20 cm. long, otherwise the sutures are almost certain to tear out, defeating the purpose of the operation.
3. If effective, the uterus is left adherent over a great area high up against the anterior wall of the abdomen—more often, with involution and the continuous drag of the heavy uterus, the adhesions are likely to give way, again defeating the purpose of the operation.

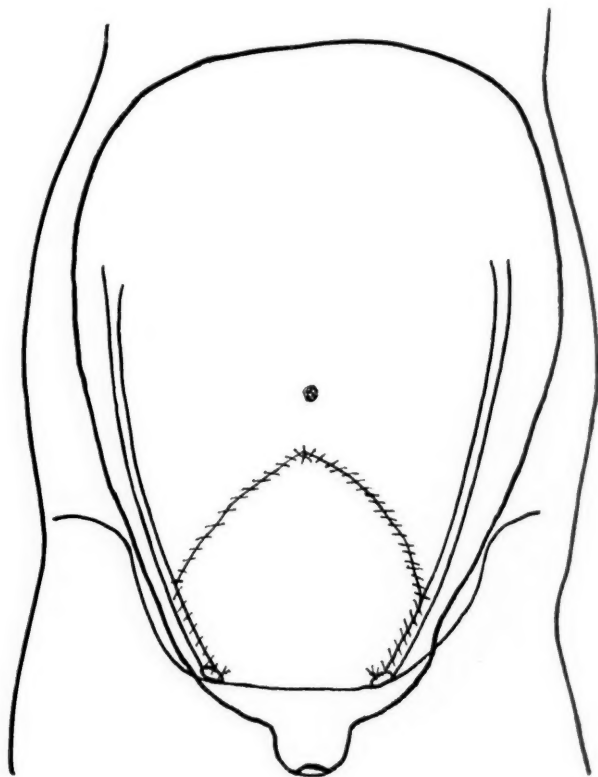


Fig. 1.

In order to eliminate these disadvantages, a line of continuous suture excluding the general peritoneal cavity from the field of operation is started at each internal inguinal ring: the round ligament is sutured to the parietal peritoneum to a level varying with the lie of the ligaments; from this level, the line of suture is carried obliquely upward and in-

ward across the anterior leaf of the broad ligament until the uterus is reached; thence to a point about 2 cm. above the top of the laparotomy incision, fixing the anterior wall of the uterus to the anterior parietal peritoneum. With the completion of both lines of suture, a Gothic arch is formed, each side and the base measuring about 17 cm., a total periphery of about 50 cm.; which is large enough to permit the delivery of almost any fetus without danger of tearing loose the lines of excluding suture. The highest part of the arch is only about 10 cm. above the pubis, and may be placed lower if a normal or small head is to be dealt with. A gauze pack is placed snugly against the lines of excluding suture, and a low type of section performed in the usual way. It has been found best to drain the excluded area by means of a roll of rubber dam, through a stab wound. There are several minor points of technic which have been found to be important:

1. If the parietal peritoneum is permitted to retract laterally during the placing of the excluding sutures, it may prove very difficult to approximate the edges of the peritoneum in the closure of the laparotomy wound. This retraction is prevented by holding the edges of the peritoneum with forceps until the excluding sutures are completed.

2. The first stitch at each inguinal ring must be so placed as to prevent leaving a loophole at this point—an accident which is very likely to occur if not guarded against.

3. The upper point of the arch of sutures must be at least  $1\frac{1}{2}$  cm. above the upper end of the incision in the parietal peritoneum.

4. The stitches of the excluding sutures must be placed not more than 5 to 7 mm. apart.

Several theoretical objections to the operation are immediately apparent: these may be stated as questions, the answers consisting of such conclusions as we have been able to draw from the limited material.

1. Will the excluding suture and its consequent zone of adhesions be adequate to the restriction of a developing peritonitis to the excluded area? In none of the cases was there any suggestion of diffuse peritonitis, although definite peritonitis limited to the excluded area occurred in 21 of the 26 cases; in 3 suppuration continued after the healing of the stab wound, and in these the borders of the abscess followed sharply the Gothic arch of the excluding sutures.

2. Is involution interfered with by the abnormal location and fixation of the uterus? So far, there has been no evidence of subinvolution (except as is usual in puerperal infection), either immediate or delayed.

3. How long does the uterus remain fixed high in the abdomen? In all cases until after the active inflammation has completely subsided, a period occupying from a few days to eleven weeks in this series. The uterus was found to have returned to an apparently normal position: in 8 cases, one month after the subsidence of active inflammation; in 13 cases, two months; in 5 cases, three months.

4. Are there any sequelae attributable to the operation itself? Twenty-three cases have been followed to date. One patient complained of chronic pain in the left lower quadrant; laparotomy discovered massive adhesions involving sigmoid

and adnexa. Sixteen patients have had subsequent pregnancies: in 9 of these the indication for section was permanent, and subsequent ordinary sections were done (once in six cases; twice, with hysterectomy, in 3 cases); in 7 cases the indication for section was not permanent—delivery was effected in 6, the other being sectioned with hysterectomy for sterilization. Five patients had subsequent laparotomies (fibromyoma, cystadenoma, torsion, adnexitis, sterilization). In all of these note was made of the remarkable comparative absence of adhesions.

5. Is the operation justified by a reduction of mortality or of permanent morbidity in either mother or child? As noted above, peritonitis is the chief cause of death after section in infected cases. It was possible to obtain figures covering 16 similar cases in which ordinary section (classic only) had been performed by other operators. The contrast is evident in Table I. In the latter series peritonitis was the determining cause of death in the 12 fatal cases. Certainly, this operation brings about no reduction in morbidity or mortality from puerperal infection other than peritonitis; it is merely a matter of luck that the 15 grave and 9 moderate cases of metritis, cellulitis, thrombophlebitis, etc., escaped without mortality. As regards permanent maternal morbidity: there was only one case, and that of a minor nature, in the 23 traced cases (except, of course, certain morbidities due to the puerperal infection itself). For comparison, the results in 12 similar cases of many years ago, managed under the methods in vogue at the time, are presented in Table I. There is little doubt as to the effect of section on fetal mortality and morbidity—this is also evident from the comparisons in Table I.

TABLE I. RESULTS IN INFECTED CASES OF TYPES DESCRIBED, AS DELIVERED BY VARIOUS METHODS

	TOTAL CASES	MA- TERNAL DEATHS	MATERNAL MORBIDITY		FETAL MOR- TALITY	PERMANENT FETAL MORBIDITY
			IMME- DIATE	PERMA- NENT		
Section with exclu- sion	26	0	24	1	0	0
Section without ex- clusion	16	12	4	?	?	? (other operators)
Hirst	2	0	2	1	0	0
Latzko	4	0	4	1	1	0
Latzko, author's modification	1	0	1	0	0	0
Deliveries per vaginam: Destructive opera- tion on fetus	2	0	2	1	2	
High forceps	3	1	3	?	2	? (other operators)
Version and ex- traction	1	0	1	?	1	(other operators)
Pubiotomy	4	1	4	2	1	? (other operators)
Pubiotomy with hysterotomy	2	1	1	1	2	(other operators)

It should be definitely understood that this operation is not offered as an absolutely safe means of dealing with cases of the type mentioned: it is entirely possible that another series may show a high mortality.

Neither is this an operation for the occasional operator; to be performed with a maximum factor of safety, the excluding suture should be as carefully made as is necessary in extensive intestinal anastomosis.

2202 AVENUE M.

#### DISCUSSION

DR. P. BROOKE BLAND, PHILADELPHIA, PA.—In the first place most of us, I assume, look upon cesarean section as, technically, one of the easiest as well as one of the simplest major operations performed within the abdominal cavity. This simplicity, together with its drama or comedy, has led practitioners in general to become somewhat cesarean section minded. There is more levity with cheap stage play taken with cesarean section than any operation I know.

Though the practice is fairly common in many large institutions, it is far more frequent in the "small town hospitals" and in those with an "unbridled" staff. In institutions with "enforced" regulatory measures regarding staff privileges and conduct it is far less frequent. In my clinic as well as in many others throughout our land no member of the staff is permitted to perform a cesarean section without consultation with the supervising head or some other authoritative member of the department. This feature of departmental conduct should be made obligatory for staff membership, regular and courtesy, in every institution in this country.

Even in the most favorable concurrence of circumstances one encounters more complications, both immediate and remote, following cesarean section than almost any other abdominal operation. In my clinic the morbidity as well as the mortality is far higher than, for example, after a clean hysterectomy. Postoperative morbidity is always greater, and this implies that its sequel, mortality, must follow in a certain number of cases. Obviously, it is not possible to have the one without the other.

In the so-called clean or elective cases it is my custom to practice the classical procedure. I have been led to follow this course because in many instances my efforts to perform the low operation have been more or less frustrated, ending in a sort of surgical compromise, with part of the incision in the cervix or lower segment and part in the uterine body itself. In observing other workers perform the low section, I have on many occasions been impressed by the operation ending in precisely the same manner.

Heretofore, the numerous varieties of extraperitoneal and pseudoextraperitoneal methods have not made a compelling appeal to me. Since any plan or suggestion coming from Dr. Cooke is founded on practical experience, he almost persuades me to become an extraperitoneal cesarean sectionist, especially in cases of a suspicious character. However, in the frankly infected I believe the highest service is rendered by adopting a more radical plan, particularly if a patient has already one or more living children. In this group, following the delivery of the child, I extirpate the uterine body or remove the organ intact.

To leave a uterus literally sizzling with streptococci and at the same time discharging legions of these organisms into the blood stream seems to me wholly inadequate. In cases of this type it may be necessary at times, because of the mandate of a patient for future motherhood, to follow a less radical course, so here again one may apply the technic developed by Dr. Cooke.

DR. FRED L. ADAIR, CHICAGO, ILL.—Actual genital infection of the parturient woman has been considered a contraindication to any type of cesarean section except in case of the absolute indication when it should be associated with a



TABLE I. TWENTY PORRO OPERATIONS WITHOUT MATERNAL MORTALITY

UNIT NO.	INDICATIONS	FEBRILE BEFORE OPERATION	HOURS		HOSP. DAYS	FEBRILE MORBIDITY		REMARKS
			IN LABOR	B. O. W. RUPT.		BRITISH	STRASSBURG	
42998	Face presentation	37.8	15	20	15	0	0	Attempted conversion and bag induction
58650	Disproportion	Potential	30	30	10	0	0	Artificial rupt. of B. O. W. Bag induction 4 hr. before operation
63389	Uterine inertia	Potential	24	10	14	X	0	Upper respiratory infect.
65955	Flat pelvis; brow	37.4	14	24	14	X	X	P. O. bronchitis. Art. rupt. B. O. W. 24 hr. before
67221	DDDS, test of labor	Potential	12	20	14	0	0	2 vaginal examinations
70310	Flat pelvis, previous section	37.4	0	0	14	X	X	Marked blood loss
71616	Central placenta previa	38.0	15	18	14	0	0	
	Contracted pelvis							
	Partial rupture uterus							
80634	Marked disproportion	37.3	36	7	14	X	0	Numerous rectal and 1 vaginal examinations
88731	Flat pelvis, DDS	Potential	14	13½	46	X	X	
97180	Flat pelvis	Potential	16	14	21	X	X	Wound infection
90756	Breech, contracted pelvis	Potential	12	10	14	X	0	Feet in vagina, 3 hr. vag. exam. at home
91075	Placenta previa	Potential	0	18	14	0	0	Artif. rupt. B. O. W.
97181	Placenta previa and abruptio	38.0	16	14	21	X	X	Bag insertion 14 hr. before oper.
105360	Flat pelvis; test of labor	37.6	18	18	14	X	0	2 vaginal examinations
108673	Flat pelvis; test of labor	Potential	20	21	13	0	0	One vaginal examination
109352	Rachitic dwarf; previous section	Potential	0	14	12	0	0	Unsterile vaginal
115872	Abruptio placentae	Potential	6	0	12	X	X	Bag insertion 4 hr. prev.
117966	Cervical dystocia	37.4	52	35	15	X	X	3 vaginal examinations; peritonitis
119740	Cervical dystocia	Potential	48	24	11	0	0	2 vaginal examinations
120374	Uterine inertia	Potential	23	17	20	X	0	

hysterectomy or Porro operation. The absolute indication for cesarean section exists when it is not possible to deliver either a living or a dead baby through the parturient canal without serious damage or danger to the mother.

We recognize parturient cases with potential or actual genital infection. In the potential group we place those patients who have been exposed to genital infection by vaginal examination or manipulation during labor, those who have been in labor twenty-four hours or longer and those in whom the membranes have been ruptured twelve to twenty-four hours or longer. We do not perform any type of cesarean section on these patients if they can be delivered through the natural passages with relative safety to the mother and baby. Where the exposure has been considerable, a Porro hysterectomy may be a necessary sequence to an indicated cesarean section.

The actually infected patients include those who present clinical and laboratory evidence of an infection with or without localizing genital findings. In the latter group those without findings which locate an infection as extragenital are regarded as having a genital infection. Our opinion is that all actual infection is still a contra-indication to cesarean section. The only indication for cesarean section in these cases is the absolute one, i.e., where a dead fetus cannot be delivered even by craniotomy through the parturient canal. When a cesarean section is necessary, we believe a hysterectomy is a necessary sequence.

With due respect for Dr. Cooke's opinion and recognition of his technical contribution to the performance of cesarean section which may increase the safety of the operation in properly selected cases, I must stand opposed to the adoption of the procedure proposed in infected cases except in those in whom there is an absolute indication for a cesarean section.

In such cases his operation may be as safe or safer than a Porro, though hysterectomy following cesarean section has in our clinic been followed by the results given below. We have records of 20 Porro operations in infected cases. Of these there were 12 potential and 8 actual infections. There were additional indications for hysterectomy in many of these patients. There was no mortality in our series (Table I).

I am sure a high mortality will follow in the wake of an extensive use of the operation described today in infected cases. I appreciate the fact that Dr. Cooke may have contributed a technic which will add to the safety of extraperitonealizing a cesarean section where it is absolutely indicated, but I am compelled to advise that its use be restricted to those unusual cases where the indication for cesarean section is absolute and in some of the patients who have potential but not actual infection.

DR. LOUIS E. PHANEUF, BOSTON, MASS.—Dr. Cooke has mentioned the Kroenig, Latzko, Hirst, Porro, and Portes operations. I have had experience with them all and feel that each has a place in the obstetrician's armamentarium. My own practice has been to employ the Kroenig type of operation, which I prefer to do with a transverse incision in the lower segment, for the ordinary type of case even after an efficient test of labor. For the woman who has had a long labor, ruptured membranes, vaginal examinations, and who shows some signs of exhaustion I have had recourse to the Hirst operation, referred to as peritoneal exclusion and which I have always performed by means of sutures. As to the Latzko operation, I have not convinced myself that this offered greater protection against peritonitis than does the Hirst procedure.

To show to what extent the Hirst peritoneal exclusion protects against peritonitis, I would cite the case of a young woman operated upon by this method in 1919.

She was admitted with signs of severe sepsis after a neglected labor. Sometime after operation both abdominal and uterine incisions broke down in their entire length and pus was discharged freely from the uterus through the cervix and abdominal incision for nearly three weeks. The sterile hand introduced through the abdominal incision reached the posterior wall of the lower uterine segment. Her sepsis was so intense that the entire endometrium sloughed away and she has never menstruated since. Yet, during this time, she showed no signs of peritonitis and made a good recovery.

I have saved two severely neglected women by the Portes operation, one of whose endometrium also sloughed away and she ceased menstruating. With this procedure the pelvic organs may be preserved as they were in my two cases, or, if necessary, they may be sacrificed after the patient is out of her shock, really doing a Porro operation in two stages.

I have performed 68 peritoneal exclusion operations by means of sutures with gratifying results and would like to show the technic employed by means of four slides.

DR. S. A. COSGROVE, JERSEY CITY, N. J.—While it is undoubtedly true that procedures embodying the Hirst principle are simpler and quicker than true extraperitoneal operations, accidental tears of the peritoneum during their course do occur, and when so occurring are of much more serious import than when the same accident occurs incident to extraperitoneal section. I have made limited use of the Hirst principle, and concede its occasional feasibility under circumstances where low extraperitoneal section would be contraindicated, as perhaps in placenta previa. But, no matter what the difficulties and dangers alleged against extraperitoneal section, its increasing and successful use in the hands of a considerable group of surgeons must be a final and complete answer to allegations against it.

Jellinghaus revived interest in the Latzko section at the New York Lying-In Hospital in 1923. Kyle B. Steele reported from that institution in 1930 (*Am. J. Obst. & Gynec.* 19: 747) a series of 59 cases with a gross maternal mortality of five cases, or 8.5 per cent.

Henry T. Burns reported in 1934 (*Am. J. Obst. & Gynec.* 28: 552) a collected series of 79 cases, from 14 hospitals in the New York Metropolitan area, by fourteen different operators, with 2 maternal deaths, or 2.5 per cent, and with postoperative morbidity of only 52.6 per cent.

Albert H. Aldridge in 1937 (*Am. J. Obst. & Gynec.* 33: 788) reported a series of 27 cases from the Woman's Hospital in New York, with 1 death, 3.6 per cent. The average number of morbid days was 8.2, the average maximum postoperative temperature 102.6°F.

It is my privilege to report here, from the Margaret Hague Maternity Hospital, in a period of six years, 74 cases of Latzko extraperitoneal section, with 2 deaths, 2.7 per cent. Gross newborn and neonatal mortality, 7 cases, 9.4 per cent. Morbidity was 76 per cent; average number of morbid days, 5.1; average maximum fever, 102.6°F. There were ten different operators.

Dr. Steele in his article said, "... If it were feasible" spinal anesthesia "would be ideal" for this operation. This opinion we heartily concur in, and 68, or 92 per cent, of our cases were performed under spinal anesthesia.

Dr. E. G. Waters of our staff recently developed, without knowledge of its previous use, an approach to the uterus above the bladder, much like the old "Sellheim I" operation, but with a transverse section of the uterus. This procedure closely corresponds with Dr. Cooke's "modified Latzko" technic, but is simpler. Several of our recent cases have been done in this fashion, and Dr. Waters will subsequently report our experience with this technic.

We have then, in recent reports from a small area, 239 cases from 17 hospitals, in the hands of more than thirty operators, with a total mortality of 4.1 per cent, in a class of cases which constitutes *a priori* desperate operative risk. An operation which can yield this result cannot be passed over casually.

DR. COOKE (closing).—Disproportion on account of contracted pelvis was the indication in 16 cases. There was another group in which the fetus was too large for the normal or slightly contracted pelvis. The important group was composed of the patients in whom attempts to deliver were made before the patient was brought into the hospital with ruptured membranes, incompletely dilated cervix, etc. We consider such patients definitely infected.

I agree with Dr. Bland that cesarean section in infected cases is the most dangerous procedure in obstetrics. A survey in my own city showed that a group of operators had a mortality of 18.75 per cent in their general cesarean section work, and it is from this group that these twelve cases cited were derived.

Personally, I have always been afraid of cesarean section with hysterectomy. In a patient who has been in labor for a long time, it is dangerous to cut across the lower segment of the uterus or the cervix. The great gap so created, which is laden with bacteria, is left more or less open into the peritoneal cavity during the time required for hemostasis and peritonization. I have done this operation on more than one occasion; but I usually reserve it for the patient in whom a definite indication for sterilization exists.

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### THE PRELIMINARY STAGE OF LABOR\*

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BY THE "preliminary period of labor," I designate all the presumptive symptoms of labor that may be present before there is evidence of progressive softening, effacement, and dilatation of the cervix. This term was suggested by the observation of patients sent into the hospital with pain that persisted for hours or even days without notable evidence of progress. From watching this group of patients, I was frequently in doubt as to whether a patient was in labor. Later, as I analyzed case records, I was impressed with two problems in the management of this period.

First: The influence the management of this period had on the succeeding stages of labor.

Second: The high instance of interference that seemed to have its incipency in this period.

The psychology of patients developed from hours of pain without progress was a problem of major importance. All patients had had prenatal care, and they were made familiar with the importance of cooperation during the prenatal period. In an attempt to control the psychology of patients during this preliminary period, full information was given to

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each patient at the time of her prenatal visits. She was told that there might be a period of pain of many hours without progress. We also described the types of pain that might be present during this period and the symptoms of true labor. The results were most surprising. At the time of labor, patients discussed the symptoms they were experiencing and many times differentiated progress pains from preliminary pains. Rest periods were asked for instead of complete sedation. Later patients discussed their "preliminary period" of labor rather than "long labor" and "rest periods" rather than "painless labor."

Such observations interested me, but as yet my observations were only an impression. One thousand consecutive cases were studied, and our findings are presented as a basis for discussion.

A study of 1000 cases reveals the data as shown in Table I.

TABLE I

<i>Preliminary Labor</i>				
	TOTAL CASES	TOTAL NUMBER WITH PRELIMINARY LABOR	TOTAL NUMBER WITHOUT PRELIMINARY LABOR	AVERAGE DURATION PRELIMINARY WHEN PRESENT
Primiparae	539	375	164	15 hr. 51 min.
Multiparae	461	306	155	15 hr. 7 min.

<i>Average Duration of Labor</i>				
	FIRST STAGE	SECOND STAGE		THIRD STAGE
		WITH PRELIMINARY	WITHOUT PRELIMINARY	
Primiparae	9 hr.	2 hr.	2 hr.	9 min.
Multiparae	6 hr. 55 min.	48 min.	56 min.	8 min.

<i>Interference</i>	
PATIENTS WITH PRELIMINARY LABOR	PATIENTS WITHOUT PRELIMINARY LABOR
177 or 17.7% in 1000 cases	70 or 7% in 1000 cases

Three groups of patients were observed, those having true labors, those having false labors, and those having preliminary labors. Each group was classified from symptoms or events that suggested the nomenclature. In Group 1, true labors, there were 319 cases or 31.9 per cent.

#### SYMPTOMS AND EVENTS (GROUP 1)

1. The patient was sent into the hospital because of pain and other presumptive symptoms of labor.
2. The pains were progressively regular in time and in intensity.
3. There was early evidence of progressive changes in the cervix, notably softening, effacement, and dilatation, and changes in station.
4. Painless labors were seldom accomplished yet when sedatives were used cautiously and judiciously they were more effective in this period.
5. When a labor was well managed, the termination of labor was spontaneous or easy if interference was necessary.

In Group 2, false labors, there were 126 cases or 12.6 per cent.



## SYMPTOMS AND EVENTS (GROUP 2)

1. The patient was sent into the hospital because of pain and too often the pain was caused by the giving of castor oil.
2. The pain was characteristic since there was little or no evidence of progress.
3. There was little or no change to be found in the mechanism of labor.
4. In time all symptoms subsided from unknown causes or from the use of sedatives.
5. All patients were sent home and in time all returned to the hospital in true labor. In previous years bags had been used or the membranes ruptured to hasten true labor. We now believe that the onset of true labor is safer to the patient and that sending the patient home avoids interference.

In the preliminary group (Group 3) there were 681 cases or 68.1 per cent. It is this group that we would emphasize since the management of this period has had such a definite influence on the succeeding stages of labor.

## SYMPTOMS AND EVENTS (GROUP 3)

1. Patients were sent into the hospital because of pain and other presumptive symptoms of labor.
2. Frequently the membranes had been ruptured for twenty-four or thirty-six hours before the onset of pain.
3. In this group almost every type of pain seen in labor was observed. The pains were regular or irregular, in time and in intensity, and were described by patients as painful, cramping, or pressure pains. Most characteristic was pain without progress.
4. Even after hours or days there would be little evidence of changes in the station or changes in the cervix.
5. Sedatives would modify the pain for a time, yet the pain persisted.
6. The persistency of the pain and the lack of progress made it impossible to send patients home.
7. Prenatal judgement that the patient could have her baby enabled us to wait complacently. Rupturing the membranes in selected cases seemed to have merit, but we were not convinced that it should be done routinely. However we were convinced that the use of bags is contraindicated in this period.
8. In time there was definite progress in the mechanism of labor, especially descent and progressive changes in the cervix, notably softening, effacement, and dilatation.
9. If this period was well managed the onset of true labor was the same and the management the same as in Group 1.

10. With each succeeding patient, we became more convinced that the management of this period determined later interference or a normal delivery.

11. Prenatal information to patients that they could have a normal spontaneous delivery and prenatal information to patients as to the importance of this period developed a cooperation that materially influenced interference.

12. The termination of this period is marked by progressive softening, effacement, and dilatation of the cervix. If the strength of the patient was maintained, the force and intensity of pains were conserved and dilatation was frequently very rapid.

These observations with this classification causes us to attempt to answer the question, when is a patient in true labor? We now would suggest that a patient is having true labor when there is progressive softening, effacement, and dilatation of the cervix with progressive descent. Furthermore, we would suggest that all the presumptive symptoms of labor that are present before there is evidence of progressive changes in the cervix and descent be known as the preliminary stage of labor.

This period may consume hours or even days. In one case alone it was one week from the onset of pain before the patient was delivered. Yet by maintaining the physiologic balance of the patient, it is interesting to note that the patient delivered normally with a pulse rate in the eighties. It is also interesting to relate that the duration of true labor was only seven hours. In this series it was not unusual to have a preliminary period of twenty-four to forty-eight hours followed by true labor of four to eight hours and a normal delivery.

The large number of cesarean sections reported for cervical obstruction has not been in keeping with my own experience. In our midwestern area we have found if patients have the right kind of contractions the cervix will dilate. Likewise, with few exceptions if patients have the right kind of contractions the baby will be pushed through the pelvis. This experience caused me to wonder if the preliminary period of labor might not be the explanation of the error of judgment in many cases when cesarean sections are done. With this thought in mind all the cesarean sections done in 17,000 cases were reviewed and only 3 cases were found in which a cesarean section was indicated. One was a cancer of the cervix, a second was a high cervical amputation without sterilization, and the third was a high cervical amputation with ventral fixation and without sterilization.

It would seem that 3 cesarean sections done for cervical obstruction in 17,000 deliveries would warrant the suggestion that cervical obstruction per se is a rare condition. It would seem that a better understanding of this period of hours of pain without progress might limit the number of cesarean sections done for cervical obstruction.

In this series the question frequently arose as to what symptoms determine a test of labor. I recognize that this series is too small from which to make a positive statement, yet the suggestion that true labor is characterized by progressive softening, effacement, and dilatation of the cervix seems to be a noteworthy fact. At least it may serve as a basis for determining the type of pains necessary to dilate the cervix and push the baby through the pelvis.

#### SEDATION

The judicious use of morphine alone or combined with scopolamine has served me well in the management of this period. Complete sedation for hours of pain without progress has been most disappointing. I am led to believe that complete sedation is only possible with progressive softening, effacement, and dilatation of the cervix and then disappointing in many cases, if the interference rate is to be considered.

In this series there were 539 primiparae. Of this number, 164 had no preliminary period and 375 had an average preliminary period of fifteen hours and fifty-one minutes. The length of true labor of these with and without a preliminary period was eleven hours and nine minutes. There were 461 multiparae. Of this number 155 had no preliminary period while 306 had a preliminary period of fifteen hours seven minutes. The average duration of true labor of those having no preliminary period was seven hours fifty-nine minutes while those with a preliminary period had seven hours fifty-one minutes. The interesting problem was that both in the cases of primiparae and of multiparae where there was a preliminary period, it was slightly more than fifteen hours, which emphasizes the hours of pains that were present without progress. These facts suggest a different conception of the duration of labor and should be a means of differentiating those cases in which sedatives are most successful.

Another point of interest was that those patients having no preliminary period had an interference incidence of 7 per cent, while those with a preliminary period had an interference incidence of 17.7 per cent or a total of 24.7 per cent against a similar series that had an interference incidence of 47 per cent. This thought became the more impressive as patients were instructed prenatally what to anticipate when they were sent into the hospital. Equally impressive was the change in the attitude, toward the clinical course of labor, as members of the staff, internes and nurses developed this conception of hours of pain without progress.

It is very evident that interference is the fungus growth that is dwarfing our maternal and child welfare development. I do not believe our national superinterference has had a malicious environment; however there is sufficient evidence to warrant the suggestion that leaders in our specialty frequently do not appreciate the far-reaching effects of their influence. Too often well thought out procedures for definite groups become routines to the detriment of expectant mothers. It is my belief

that a more complete knowledge of the clinical course of labor and a better understanding of the significance of pain will go far toward lessening interference.

In the many years I have cared for women in labor my problem has been those patients with hours of pain without progress. My own mistakes of management and the high incidence of cesarean section and other forms of interference seen and being reported, cause me to suggest the preliminary period of labor as a part of the clinical course of labor.

1107 BRYANT BUILDING

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### WHAT IS MEANT BY THE TERM "TEST OF LABOR"?\*

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CASES of pregnancy complicated by contracted pelves which are classified as "borderline" give us great concern as regards the proper method of delivery to be selected and it is in this group that the "test of labor" is frequently employed. Painstaking study, including pelvimetry, the x-ray, the use of various methods of impressing the head into the pelvis prior to labor, etc., may all leave us uncertain as to the ultimate outcome. The "test of labor" remains the final criterion, and upon its outcome we base our decision in favor of or against the performance of cesarean section. In obstetric literature, however, there is considerable lack of agreement as to the exact meaning of this term, which is reflected in our teaching, to the confusion of medical students and practitioners.

A consideration of the various definitions may be of interest. This is best done by reviewing the statements found in some of the many obstetric textbooks in use at present.

Bumm,<sup>1</sup> speaking of pelves with conjugate vera from 7 to 9 cm. states: "The decision, whether the natural course should be awaited, or whether to interfere, and when and how this is best to be accomplished, is to be deduced not alone from the degree of the contraction. Equally should be considered, whether the head is large or small, whether its consistency is firm or compressible, whether it presents favorably, whether the action of the pains and of the abdominal pressure is regular and strong or not. All these cannot be observed and evaluated correctly before the rupture of the membranes. It follows therefore that in middle grade contractions nothing remains in the beginning of labor except to wait. . . . In the clinic the management of cases of moderate pelvic contraction turns out to be fairly

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simple; first of all one must observe the effect of the expulsive efforts. If we realize that a spontaneous overcoming of the narrowing by the head is unlikely, so will the child be disengaged through a cesarean section above the pelvic ring, or room will be provided through the opening of the pelvic ring—pubiotomy." It can be seen that Bumm considers the rupture of the membranes to be an important factor; however, he makes no statement as to the degree of cervical dilatation.

DeLee,<sup>2</sup> while not formulating a definition of the term, advises that labor be allowed to proceed to full dilatation of the cervix, with avoidance (if possible) of premature rupture of the membranes; after the beginning of the second stage, the patient is observed in order to see what molding may accomplish, but a second stage test of two hours is considered sufficient.

Stander,<sup>3</sup> in his revision of Williams' textbook, draws a distinction between a "trial labor" and a "test of labor." Thus: "By 'trial labor,' we mean, in general, from four to six hours of fairly active labor, the pains coming every ten minutes, lasting for forty to sixty seconds, and being fairly strong in character. . . . 'Trial labor' must not be confused with a true 'test of labor,' by which is understood a labor up to the point of full dilatation of the cervix for a period of two hours or longer with the membranes ruptured." He states that very few of his patients with contracted pelvis are subjected to the test of labor, a trial labor usually enabling him to foretell whether or not pelvic delivery will be feasible. He states, however, that engagement and molding occur only after the resort to the test of labor.

Irving<sup>4</sup> states: "No set rules can be laid down for the conduct of a test of labor, and each case must be decided on its merits. The test may last from a few hours to forty-eight hours or more, and may in rare instances even include two hours in the second stage of labor. Our policy has been to perform cesarean section if no progress has been made after a reasonable number of hours of hard labor." It will be noted that in most cases, he confines the test to the first stage of labor.

Titus,<sup>5</sup> in writing of the management of the relative and borderline types, says: "Cesarean section will be undertaken if a few hours of vigorous first stage pains fail to develop at least some evidence that the head may engage." Later, he refers to "not merely a test but a trial of labor," in patients for whom hospitalization is impossible. It will be seen that his conception of the terms differs from that of Stander.

Beck's<sup>6</sup> opinion is in accord with that of Stander. He states that a real "test of labor" consists of at least several hours of active labor after the beginning of the second stage. Should engagement fail to occur, craniotomy is the safest procedure, though the low or the Porro section might be used, according to the conditions present. In cases of a diagonal conjugate of 10.5 to 11.5 cm., he prefers the "test of labor," whereas in patients with diagonal conjugates of 9.5 to 10.5 cm. he employed the "trial of labor."

Bland<sup>7</sup> says: "With moderate overlapping of the head the patient may be given, under every possible aseptic safeguard, the test of labor; but if after a trial of six or eight hours of hard firm contractions no progress is evident, delivery may be effected by a low cesarean section." Note that there is no reference to the condition of the membranes or of the cervix; the only criterion stated is that of six to eight hours of hard firm contractions.

Vaux,<sup>8</sup> in his revision of Edgar's textbook states: "If after several hours of second stage contractions the head has shown no tendency to engage and descend some, the likelihood of spontaneous delivery or of delivery by forceps or version is quite out of the question."



Shears<sup>9</sup> says that a test of labor should be given to patients with the conjugate vera between 7.4 cm. and the normal, but he does not define the term. "If at the end of two or three hours a careful examination shows that the head is still above the brim with no prospect of engagement, and confirms the fact that distinct pelvic narrowing exists, cesarean section or pubiotomy should be performed."

Cornell,<sup>10</sup> in Davis' system, feels that "any patient whose labor is well established, who does not progress normally under proper narcosis, has been given a test of labor, regardless of the amount of dilatation of the cervix." He gives the average time for the test as twelve to eighteen hours, and says that it is not fair to the patient, the baby, or the obstetrician to allow a woman to remain in the first stage indefinitely.

Reed and Sabin,<sup>11</sup> in Curtis' system, recommended the policy of permitting labor to progress for a reasonable time, but do not mention "test of labor" or "trial labor."

Lavake<sup>12</sup> mentions the test of labor in borderline pelves, but does not define the term.

Harper<sup>13</sup> counsels expectancy in "moderately contracted pelves": "Allow things to proceed as long as they are going along normally."

Wallich<sup>14</sup> advises expectancy "to observe the effect of the natural forces, to allow, so to speak, the head to measure the pelvis." Failure of engagement is to be followed by symphysiotomy (in certain cases) or by cesarean section. No details of the test are given.

Tweedy, Wrench, and Solomons<sup>15</sup> simply remark "cesarean section may appear the best method of delivery if there is great mobility and overriding of the head above the brim early in labor."

Eden and Holland<sup>16</sup> do not mention the test of labor. DeSeigneux<sup>17</sup> inclines to the view held by DeLee, Stander, and others; thus: "One cannot appreciate, before the rupture of the membranes, the possibility of the engagement of the head. The effort of the uterus acts directly upon the head only after the escape of the water, and it is only then that the head can mold itself sufficiently to pass, if that is possible, the contracted superior strait."

From the above it appears that obstetricians are not in accord in their conceptions of the test of labor and that the situation is further complicated by the use of the term "trial labor." Generally speaking, it seems that the term "trial labor," or "trial of labor," as at present employed, would best be defined as follows: the patient is allowed to go into labor spontaneously; after regular and fairly strong first stage pains are established, she is carefully observed for several hours, and the engagement or lack of engagement of the head is noted. The term "test of labor," as defined by some writers, means that the second stage has been reached, the membranes are ruptured, labor is allowed to proceed for two (or rarely more) hours, in order to see if molding and engagement might occur.

At this point, I wish to refer briefly to two papers detailing the results of tests (or trials) of labor in borderline contracted pelves. Others might be quoted, but these, one from the Red Cross Hospital of Lyon (France), and the other from the Johns Hopkins Hospital, can be considered as fairly representative of the conservative attitude. In

each series, extreme conservatism prevailed, and the results would appear to indicate that this attitude is reflected in each series in a high fetal death rate.

Peckham and Kuder,<sup>18</sup> reporting on 422 cases in Johns Hopkins Hospital in which the test of labor lasted thirty hours or more, found a gross fetal mortality rate of 19.23 per cent; a corrected fetal mortality rate of 13.56 per cent, a gross maternal mortality rate of 1.36 per cent, and a corrected rate of 0.91 per cent. Rhenther, Bucher, and Chartel,<sup>19</sup> in 141 cases of slightly contracted pelvis (*bassins limites*), reported the results after the test of labor (*l'épreuve de travail*), with a "careful and sufficiently prolonged observation after the rupture of the membranes." There were three maternal deaths; one from toxemia, one from septicemia after low cesarean section, and one from "obstetric shock." One hundred thirty-four of the 141 were delivered vaginally, 7 were subjected to low cesarean section. Twenty babies were lost, giving a fetal mortality of 14.2 per cent. The authors conclude that better results were obtained by the employment of the induction of premature labor; in 100 cases thus treated the maternal mortality was 0 and the fetal mortality 13 per cent.

Based upon this review of the varying and more or less conflicting views of the authors quoted and upon a consideration of what really appears to be the course that the majority of obstetricians actually adopt, I would suggest that the following would be a proper conception of the test of labor. It would appear wise to eliminate the terms "trial of labor" and "trial labor" entirely.

In a pregnant primiparous woman with a borderline contracted pelvis (c.v. of 7 to 8 cm. in a flat pelvis or 7.5 to 9 cm. in a generally contracted pelvis) spontaneous labor is allowed to establish itself (the head is not engaged). After regular and fairly strong pains are established, occurring every five to ten minutes and lasting thirty to sixty seconds, labor is allowed to proceed for from four to eight hours, during which time the fetal heart tones are carefully watched. Some form of analgesia is advisable. The position of the head is noted by abdominal palpation, which may be checked by two or three (not more) rectal or very aseptic vaginal examinations. Should definite engagement occur, the feasibility of vaginal delivery is established. Should engagement not occur, or should the heart tones show fetal embarrassment, cesarean section, preferably of the low type, is to be performed.

To this conception, two objections might be raised. First, it is held by some that molding and engagement of the head in such a pelvis cannot occur until the second stage is established. With this idea I am not in complete accord; it is correct as regards the severer grades of disproportion, but not so far as the milder varieties are concerned. When it does occur, in cases falling in the first group, after what may be called the "true test of labor," a prolonged and difficult second stage is the rule, with a tedious forceps delivery and high fetal morbidity and mortality rates. The other possible objection would be that the cesarean section rate in the borderline group would be raised. If so, this

would be offset by the lessening of the maternal risk as compared to the risk of the severer test, and by the much more favorable outcome as regards the infants. I feel that the conception proposed is really the one which is entertained by most obstetricians, and that the situation would be clarified by the universal adoption of some such formula.

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931 CANAL STREET.

## DISCUSSION ON THE PAPERS OF DRS. HAMILTON AND KING

DR. CHARLES W. MUELLER, BROOKLYN, N. Y. (By Invitation).—It is my opinion that this preliminary stage, as described by Dr. Hamilton, does actually exist. With the same premise in mind I have reviewed a series of 500 cases from the King's County Hospital of Brooklyn. Due to the short period of available time my results cannot be compared with the painstaking details presented by Dr. Hamilton but a few of my conclusions may be of interest.

We believe that less than 68 per cent of patients have this preliminary stage of labor. Also it appears that the duration of this stage is much less than fifteen hours or his average.

A large percentage of our patients are of Jewish and Italian descent. Their emotional traits may lead to a misinterpretation of the exact time of the onset, as well as the severity of their labor pains. Furthermore, in a hospital where the clinic patients are aware that their care is to be free, admissions occur for little or no pain. For these reasons our percentage of preliminary labor and of false labors should be high. Yet, I am sure that 12.6 per cent of our cases could not be classified as false labors. In my private practice false labor is relatively rare.

We have encountered a fair number of cases in which labor became established with a definite effacement as well as dilatation of the cervix and even with some descent of the presenting part, but in which progress would then be arrested for a number of hours. This might be termed an arrested first stage. Usually termination of labor is successful without interference in these cases.

I had hoped that the essayist would present a theory of the cause of onset of labor. This might explain why some patients have a preliminary stage while others have such an active, short, normal labor. Would a peculiar endocrine status explain this? If the onset of labor were due to the increase or decrease of some endocrine secretion, would not a lessened stimulus produce our so-called preliminary stage?

DR. H. L. GAINNEY, KANSAS CITY, KANSAS.—In the Kansas City District, I know of two hospitals with incidences of 32 per cent cesarean section in one and 14.7 per cent in another. In the latter I had an opportunity to review the cases and was able to class at least 75 per cent of them as cases of so-called preliminary labor. Cesarean sections were done by general men, the patients having been in labor for ten to eighteen hours without progress. Contraction of the pelvis was obviously not a factor. We noted in every case definite softening of the cervix and in most cases a descent of the head which would certainly mean that there was progress if not actual dilatation of the cervix. If this new term offers no more than the opportunity to bring about a discussion of the normal cause of labor among general practitioners it justifies itself.

DR. A. N. CREADICK, NEW HAVEN, CONN. (By Invitation).—In those institutions with adequate x-ray facilities pelvic mensuration and fetal measurements have greatly facilitated accurate observation. I still wait to take an x-ray until at or near term. The disadvantage of increased bulk and interposed fetal small parts is outweighed by the advantage of seeing the relation of that particular fetal head to that particular pelvic canal. It is difficult to estimate the dystocia due to increased pelvic inclination. The diameters of the fetal head may be measured by x-ray but the advantages to be secured by molding are not evident. Synclitism likewise cannot be measured.

The chief variable factors that remain are the voluntary and involuntary expulsive forces. It seems to me that this discussion can begin with such suggestions as these: (1) The term trial labor must be understood. (2) A careful analysis of the relation of presenting part and pelvic canal is essential. (3) No real disproportion being apparent, adequate contractions may be permitted. (4) No real trial is effective until the cervix is completely dilated. (5) Final dependence is put on vital signs of mother and fetus.

The chief disturbing factors to such a program are: (1) Pressure by the laity for a more active attitude. (2) Facility of performance of cesarean section. (3) Relative safety of cesarean section when done early, without too long an interval between rupture of membranes and time of operation, and when done without vaginal examination. (4) Certain occipitoposterior presentations causing edema and thickening of the cervix instead of its effacement. (5) The seriousness of any operative delivery where delayed until heart sounds show distress or maternal signs betoken exhaustion.

In the clinic at Yale, both in ward and in the private cases, induction during the thirty-six to forty weeks is practically abandoned. The incidence of operative delivery is rising. The duration of time allowed for trial labor is materially shortened. The old teaching of Williams of "Two hours of adequate contractions after complete dilatation" is outmoded.

DR. J. C. LITZENBERG, MINNEAPOLIS, MINN.—Twenty years ago I abandoned the term "test of labor" in borderline contracted pelvis. However, we do have to give a test. Remembering the mechanism of labor, a test may be applied as labor does or does not progress through the various steps of the mechanism of labor. The first thing that happens is fixation of the head, and the next is engagement of the head. Engagement is now defined as the descent of the presenting part to the spines

of the ischium. If we want to find out whether this head can go through we want to know first whether it will become fixed and secondly if it will become engaged.

For twenty years I have used three terms in determining the test of labor: first, the "trial of fixation"; second, the "trial of engagement"; and finally, the "trial of labor." This last I accept as being a complete effacement and a complete dilatation, and rupture of the membranes, followed by a few hours of good second stage labor.

The decision as to procedure must often be made earlier than the final trial of labor because a long labor, of more than six hours, is a dangerous thing if cesarean section be contemplated. The borderline cases with contracted pelvis are given the trial of fixation. Now the head does not necessarily have to be fully engaged for us to say this patient will come through, but if a patient will fix the head she will usually engage it, and if the head becomes really engaged it will usually deliver. By carefully observing the possibilities of fixation and engagement, one may often determine the possibilities of birth without subjecting the patient to the final test of labor.

It has been my observation that the preliminary stage of labor is almost never without some evidence of progress. I have had many of these cases of patients that Dr. Hamilton has discussed today, have had them go home after these distressing few hours of labor, and almost never have they come back without showing that progress was made. There is always some degree of effacement, sometimes a considerable degree of dilatation, although that is not so common.

DR. RUDOLPH W. HOLMES, CHICAGO, ILL.—I would regard true labor as starting only when the cervix gives evidence of structural changes, namely, softening and beginning dilatation. We must not confuse those weak, irregular contractions which precede true labor, and called by older writers *dolores praesagientes*, with true contractions of labor. The former are peculiarly phenomena of multiparous labors.

A true test of labor has been given only when the woman is permitted to progress until dilatation has been accomplished, and the membranes have been ruptured two hours. It is only when these two elements are accomplished facts that the head may descend when there is some cephalopelvic disproportion.

It is not the duration of labor which determines whether a secondary section may be performed. The vital factor depends upon what errors of omission or commission have been perpetrated during the hours of the test. I hold that there should not be any vaginal examinations during this test. No rectals should be employed until a definite indication for their employment arises. Pulse and temperature of the mother, auscultation of the fetal heart must be recorded every two hours, finally at half hourly intervals, even more frequently towards the last. During the early hours of the test the mother should be given regularly some hot gruel, soup, etc., but not milk, for the curds from the latter may be a distinct inconvenience if emesis occurs. The nurses and internes must be warned that the patient is a special risk and requires very special watchfulness.

DR. A. K. PAINE, BOSTON, MASS.—At the Booth Hospital, where we have a relatively large percentage of primiparous deliveries, we have adopted the rule that complete dilatation of the cervix must occur before the performance of a cesarean section in any relative disproportion case. Since adopting full dilatation of the cervix as indicative of an adequate test of labor, our cesarean section incidence, in the disproportion group, has dropped from 8 per cent to approximately 3.5 per cent. As for mortality, cesarean sections done after the patient has been in labor for some time represent our best group at the present time. Unexpectedly it has



also been our experience that the patients on whom we do transverse cervical operations, after full dilatation of the cervix, have relatively a more satisfactory convalescence. Obviously the low section is technically an easier operation when the lower segment is effaced and the cervix fully dilated.

Unfortunately, in 8 or 10 per cent of these disproportion cases, complete dilatation of the cervix will not occur within a reasonable length of time. We have set twenty-four hours as an approximate limit of the time we would ordinarily wait for complete dilatation. This twenty-four hours refers only to actual labor as shown by its definite effect on the cervix.

Fewer cesarean sections will be done if we allow each of these relative disproportion cases to have an adequate test of labor. An adequate test in our experience is complete dilatation of the cervix. In these disproportion cases I am unable to predict in advance of labor, with any dependable degree of success, which patient will deliver herself and which patient will require a cesarean. An adequate test of labor in each case is the only dependable approach to the problem.

DR. JAMES R. BLOSS, HUNTINGTON, W. VA.—Dr. John Polak once replied to a question I asked as to what constituted a test of labor, "If you have a woman having regularly recurrent uterine contractions, with full dilatation of the cervix, or a cervix which is dilatable, with no advancement of the head after two hours, something is wrong regardless of what the measurements are." We do cesarean sections if the patient has a cervix that is dilated or dilatable and relaxed, if there is no advancement of the head after two hours of regular uterine contractions.

I have been investigating the statistics of home obstetrics in that territory comprising the area of the Southern Medical Association, for 1935. Do you realize that 65.63 per cent of the deliveries by physicians in this territory for that year were done in the homes? We must endeavor to get information about this subject to the men who are doing home obstetrics.

DR. M. PIERCE RUCKER, RICHMOND, VA.—It is wonderful what will happen to a cicatrized cervix when the patient is ready to go into labor. I remember a patient who as a result of treatment of a cancer of the cervix with a paste had no cervix. The whole upper part of the vagina was such a mass of scar tissue that I was unable to see any evidence of an opening into the uterus. Yet when she went into labor she had a perfectly easy, normal delivery without complications.

Quite recently I saw a patient, thirty-nine years old, who, after having borne three children, had undergone a cervical amputation. Her doctor was very much concerned about her and called me in consultation twelve hours after the onset of her labor. He reported that he had made a vaginal examination and had found only a little cicatrized dimple in the upper part of the vagina. Morphine and scopolamine were given and the baby was born in bed, even before the interne could be called.

DR. E. D. PLASS, IOWA CITY, IOWA.—So far this morning no one has offered a definition of labor. Labor to me may be defined as a succession of uterine contractions leading to the gradual dilatation of the birth canal and to the expulsion of the fetus. That definition does not include the word pain, for, as you well know, pain is not an essential part of the parturitional process. If we adopt some such definition of labor, we must modify our concept of a test of labor, and define trial labor in terms of progress rather than in terms of so many hours of pain.

DR. THOMAS B. SELLERS, NEW ORLEANS, LA.—The concept of a preliminary stage of labor is applicable to a rather small percentage of cases. Nevertheless, if accepted, it will be of value in obviating meddlesome interference. It is now very

difficult to explain to the general practitioner and occasional accoucheur that the progress of labor may be normal in cases having contractions forty-eight to seventy-two hours with little or no progress. There is very little attention given to this point in the average textbook.

DR. L. A. CALKINS, KANSAS CITY, MO.—While Dr. Hamilton's work has been going on in Kansas City, we have checked his results in other hospitals of the city. We feel that, while his percentage of preliminary labors is too high, we all have seen a considerable number. We have found that it is of definite help to keep this idea before our students. Dr. Hamilton stresses the particular importance of this concept to the patient. We agree with this, but of the greatest importance is the improvement in the psychology of the doctor involved in such a concept.

DR. HAMILTON (closing).—It is possible that my enthusiasm may have influenced statistics. Nevertheless in each case a record was kept of the preliminary stage as well as the first, second, and third stages. We have attempted to differentiate true labor, false labor, and this period of pain without progress which we have called the preliminary stage of labor.

The large number of cesarean sections done for cervical dystocia again causes me to suggest the necessity of differentiating types of so-called labor. Again, may I suggest that the hours of pain without progress, form a definite part of labor and must be treated as such.

DR. KING (closing).—The main point that I wish to stress against the teaching that a test of labor requires full dilatation is that such a procedure is associated with a high mortality. Figures from Johns Hopkins show a 19 per cent fetal mortality when the extreme test of labor was allowed. In that series about 1 per cent of the maternal mortality was charged to the complications resulting from a long test of labor. If we adhere to the definition of full dilatation and ruptured membranes, are we not going to lose more of the mothers and babies than if we adopted a slightly different conception?

In this compromise test there should be evident a thinning out of the cervix, some effacement, some sign of progress if there is going to be a fairly easy delivery. After four to eight hours of real labor, if the head is still floating above the pelvic brim, with no fixation and no engagement, then it is time for cesarean section.

## THE RELATIONSHIP OF FETAL BIRTH INJURIES TO OBSTETRIC DIFFICULTIES\*

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**I**N THE two years 1935 to 1936 on the Obstetrical Service of the Toronto General Hospital there were 1,710 births, and of these 77 were stillbirths and 41 neonatal deaths, a combined rate of 6.9 per cent. Any patient who is six months or more advanced in pregnancy is admitted to the obstetric wards, and our figures include some babies weighing less than 2 pounds.

An analysis of stillbirths and neonatal deaths, totaling 118 cases, included 15 macerated fetuses (several premature); 14 deformities, incompatible with life; 34 prematures, under four pounds; 1 case of pemphigus; 1 case of ieterus gravis; 5 placenta previa; 3 accidental hemorrhage; and 1 craniotomy on a dead baby.

For these 74 fetal deaths, the method of delivery could not be held responsible, with the possible exception of the 5 cases of placenta previa.

Of the remaining 44 cases for which the method of delivery may be held responsible, there were 19 normal deliveries, including 1 bronchopneumonia of mother, 1 heart disease of mother, 4 eclamptic toxemias, and 4 prematures over 4 pounds and under 6 pounds. Also 13 forceps deliveries (3 intracranial hemorrhages), in 3 eclamptic toxemias, 1 brow, 1 face, 3 persistent occipitoposterior, and 5 for delay in second stage. Among 6 versions, there were 4 intracranial hemorrhages; in 3 breech deliveries, 1 intracranial hemorrhage, and 3 cesarean sections were done, 2 before labor commenced, and 1 after three hours labor.

Of the 19 normal deliveries, 10 were complicated as enumerated. Of the remaining 9, 2 had intracranial hemorrhage (autopsy, labors 37 and 24 hours); 3 causes unknown (no autopsy), and 4 causes unknown (autopsy).

Of the 11 cases of intracranial hemorrhage (6 autopsy and 5 clinical diagnosis), there were 4 versions (2 for transverse presentation), 3 forceps (1 high, 1 mid, 1 low), 1 breech, 1 cesarean section, and 2 normal deliveries.

A review of the clinical histories of these fetal deaths appeared to emphasize some facts worthy of consideration.

The problem of fetal birth injuries is intimately connected with that of maternal mortality, and it is unfortunate that the methods to lower the incidence of one may not have the same effect on the other. The

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researches of many observers have made it obvious that unskillful and ill-advised obstetric procedures result in many instances of fetal birth injuries, the commonest form of which is intracranial hemorrhage. This aspect of the question, however, has received such widespread recognition that an equally important side of the problem is often forgotten, with the result that any fetal birth injury has come to mean poor obstetrics in the minds of many of the medical profession, and, to an even greater extent, in the minds of the laity. I wish to discuss the question, therefore, from the standpoint of the problems that so frequently confront the conscientious and skillful obstetrician, who often finds himself on the horns of a dilemma and is not to be censured for many of the resulting tragedies to the fetus. Good obstetric practice frequently means that the child is subjected to danger of injury and this fact should be recognized. Moreover, the term "birth injury" should be used with caution. It may be an accurate term from the medical standpoint but is liable to convey a wrong impression to the laity, to whom the term is often synonymous with poor obstetrics. A patient was recently delivered on our service by outlet forceps, after an episiotomy. Labor had lasted twelve hours in the first stage and two hours in the second stage. The baby was a microcephalic child and died within two weeks. It was transferred to a children's hospital where the interne asked if forceps had been used. He subsequently told the father that the baby's head was abnormally small and it would likely die. Within an hour the father was remonstrating with me because the forceps had been used and had so compressed his child's head that it would not survive.

Some brain injuries, like the above case, are not the result of birth trauma at all, but are developmental defects or brain aplasias. Such cases may easily be mistaken for traumatic injuries without careful investigation. The use of such terms as "forceps delivery," "difficult labor," "breech presentation," etc., has too frequently placed the obstetrician in the difficult position of disproving his responsibility for many fetal cerebral conditions. Since the advent of encephalograms, many cases of cerebral atrophy, some with a history of normal delivery and others with a history of difficult labor, have been discovered. It is likely that developmental disturbances of the brain are more frequently the cause of symptoms than has usually been considered.

Even intracranial hemorrhage may be present and not be the result of trauma. One patient in our series was delivered at term, but before labor commenced, by cesarean section, the indication being a previous section. The baby died of intracranial hemorrhage, and at autopsy there was also diffuse hemorrhage in the peritoneal cavity. We know of two other cases of babies born by section who died with clinical evidence of intracranial hemorrhage. It has been shown that hemorrhagic disease of the newborn is a factor in some of these cases. Margaret Warwick<sup>1</sup>

found bleeding in other organs in 53 cases of intracranial hemorrhage. Today the obstetrician is in an unenviable position when he encounters such a case. If the delivery were instrumental that is blamed; if forceps were not used it is often suggested that the patient was allowed to go too long in a labor that should have been terminated.

We recognize that intracranial hemorrhage is usually traumatic in origin, but it may occur in so-called normal labor. In our series 2 followed spontaneous deliveries. Moreover, many babies suffer injuries not severe enough to cause death, but some of these give evidence of their injury in later life. The human fetus is not as mature at term as the fetus is in the lower animals. Injuries from the stress of parturitional forces may be bruises and abrasions, damage of the viscera, nerve injuries, depressions and fractures of the skull bones, and intracranial edema and hemorrhage. The latter, particularly, may occur with normal labor and spontaneous delivery. During labor a large proportion of children suffer some injury, for even the caput succedaneum is evidence of superficial injury, whereas a cephalohematoma is indicative of more extensive damage. As pregnancy nears term the fetal blood becomes more venous and during labor there is a retardation of the uterine circulation with each pain, and a corresponding diminution of the oxygen supply. Pressure on the fetal head forces out some of the blood with a relative cerebral anemia and asphyxia. Occasionally this is increased by the pressure of the head on a low lying placenta. In ordinary labors the process of molding takes place without severe injury resulting, but if the force is applied too suddenly or is carried beyond a given point, tearing of the internal ligaments occurs. Even without gross damage to the tentorium or falx cerebelli there may be hemorrhage inside the skull. It is common to find small hemorrhages along the sutures, under the periosteum and in the dura. Many of these are the result of asphyxia and not of a torn vessel, although a congested vessel is more liable to rupture than one not congested. It has been stated that some traumatic effect of labor on the brain can be demonstrated in 90 per cent of all newborn infants coming to autopsy. Rydberg,<sup>2</sup> however, has pointed out that in the central nervous system of the newborn child, the presence of fatty substances can be demonstrated in varying quantities. They are extracellular and have accumulated around the glial cells, the latter being unaltered. These substances are not pathologic. In cases of acute brain injury there are fatty changes within the glial cells, and it is difficult, by any method of staining, to differentiate such fat from the extracellular fat in a given section.

We have briefly reviewed some of the factors concerned in fetal injury during normal labor. Let us now consider abnormal labors.

Prolonged labor increases the incidence of intracranial hemorrhage but so do attempts to shorten these labors and here, especially, we see the doctor's dilemma. May I illustrate with the history of another case?



This was a patient, thirty years of age, who had had two previous pregnancies, the first a miscarriage and the second a low forceps delivery. There was some question whether that child had an intracranial injury but at the present time it is quite healthy at the age of five years. The patient attended our antenatal clinic, and at seven months a breech presentation was corrected by external version. She was admitted to the hospital in February with false labor pains which disappeared. Two weeks later she entered hospital in labor, having had irregular pains for twenty-six hours. The first stage lasted a further twenty hours, during which time the contractions were irregular in time and intensity. At the end of the first stage the fetal head was in midpelvis and the body lying L.O.A. She was allowed to go four hours in the second stage during which time contractions were moderately strong but occurring at irregular intervals of from five to eight minutes. Little progress was made but the fetal heart remained regular at 120-140. At the end of this period midforceps were applied and a relatively easy extraction performed. The child breathed spontaneously, was a good color, and for twenty-four hours appeared to be quite normal. On the second day a left facial palsy was noted and from then the symptoms progressed and the baby died on the sixth day. Autopsy revealed a bilateral laceration of the tentorium cerebelli with large subdural hemorrhages in the posterior fossae and also well-marked subarachnoid hemorrhages in both parietal regions.

It would appear to us that the prolonged labor in this case was responsible for at least part of the fetal injury, for it is unlikely that the diffuse subarachnoid hemorrhages in the parietal regions were the result of the forceps delivery. Yet this prolonged labor was not due to disproportion but rather to irregular and ineffectual uterine contractions. On the other hand, it is almost certain that the tears in the tentorium and the subdural hemorrhage were the result of the operative delivery. The question in our mind is whether an earlier forceps delivery might have avoided the damage.

In our series there were 21 cases in which labor lasted from twenty-five hours to four days, but in a careful review of the histories one cannot feel that attempts to shorten the labor would have been wise, except the possible use of forceps slightly earlier in the second stage in three instances (4, 4, 4½ hours). In these 21 cases there were other causes of fetal death in many instances, but the prolonged labor was probably a factor in most of them and certainly the cause in some.

If, then, prolonged labor is dangerous to the baby and attempts to shorten labor equally so, we find ourselves confronted by the question of cesarean section in the interest of the child. It is our opinion that too many sections are done with the idea of lessening the risk to the child, forgetting that with the lower fetal mortality from cesarean section, there is a corresponding increase in maternal mortality. The idea of a section to lessen the risk to the child is not new in either medical or lay literature. Laurence Stern published his *Tristram Shandy* in 1759, and in that amusing novel we find the argument for cesarean section in the interest of the child. His idea that the eldest son is usually the greatest blockhead in the family is hardly substantiated by history. Among

others, Newton, Lincoln, Leonardo da Vinci, Harvey and Goethe were all first born sons. We believe there is the occasional case where section, is justifiable, in the interest of the baby alone but we think such cases are not common. Moreover, babies born by elective cesarean section do not always live and some have serious intracranial hemorrhage. I have already noted one of the latter from our series, and of the total deaths three were delivered by section.

Closely allied to the problem of long labor is the elderly primipara with rigid soft parts and inefficient uterine muscular power. These cases probably present more difficulty in private practice than they do on a public ward service. They approach labor with trepidation, to which is added an insistence that it shall be neither prolonged nor painful. This insistence is often the result of uncritical articles in the lay press describing some method of "painless childbirth." In addition, therefore, to the ordinary causes of asphyxia, there is often the effect of drugs for the relief of pain and ill-advised attempts to deliver too soon. Much can be done to prepare the minds of such patients for labor, and the absence of relatives from her room during labor makes good obstetrics easier. The fact remains that many of these women do have long labors and some of them have injured babies. We do not think, however, that cesarean section is often indicated, in the absence of disproportion. We believe, rather, in conservative obstetrics with careful attempts to relieve pain but without a routine attempt to produce "painless labor."

The commonest obstetric difficulties leading to fetal injury are disproportion, malpresentations, antepartum hemorrhages, and eclamptic toxemia. With careful antenatal supervision, only the minor degrees of disproportion will play much part in fetal injuries, for the cases of major disproportion will be detected before labor and appropriate measures adopted. When considering the induction of premature labor in such cases, it is to be remembered that the premature child is more liable to intracranial damage than is the child at term.

The minor degrees of disproportion present a very real danger to the fetus unless one is willing to see a great increase in cesarean section in such cases. It has been amply demonstrated that the great majority of such patients will deliver themselves spontaneously or can be delivered by easy forceps operations, but their labors tend to be long and the child's head is subjected to more than ordinary molding. Moreover, the size of the child is not always the same in successive pregnancies, and this may be the determining factor in the presence or absence of intracranial injury. We believe that proper obstetrics requires conservative methods with these patients, but we hold that opinion in the full knowledge that there will be a certain number of injured babies.

Malpresentations also increase the danger to the baby. Persistent occipitoposterior positions are the commonest form. Labor is prolonged and frequently ends in operative delivery. If the first stage is prolonged,

little can be done except to see that the patient does not become dehydrated nor her strength exhausted. Certainly no attempt at delivery from below should be made until the cervix is completely dilated. Labor should be terminated by forceps delivery if the second stage is prolonged, but again we will encounter a certain unavoidable fetal mortality, although the latter will be lower with skilled than with unskilled attention. Forceps, or version with extraction, before the cervix is dilated only adds to the risk of both mother and baby. Three of the deaths in this series were in cases of persistent occipitoposterior position with forceps delivery.

The incidence of intracranial hemorrhage in breech cases is particularly high and is frequently the result of poor obstetrics. The idea, so widely held until comparatively recently, that haste was essential as soon as the child's hips were born, led to many unnecessary birth injuries. The aftercoming head has had no opportunity for molding to take place and forceful efforts at rapid extraction are very liable to result in intracranial damage. Nevertheless, with the greatest skill in the world, breech presentations will still carry with them a higher mortality than vertex presentations. The proper use of forceps on the aftercoming head is often a means of avoiding fetal injury. Three of our deaths were in breech cases, one of them having intracranial hemorrhage.

Transverse presentation usually has only one method of treatment, namely, podalic version. Many of these babies are dead when the patient is first seen and the mortality is necessarily high in the others. Three cases in this series were transverse presentations and were delivered by version. A clinical diagnosis of intracranial hemorrhage was made in two, but autopsies were not obtained. The third case had an autopsy and death was due to asphyxia and not to hemorrhage.

The antepartum hemorrhages are so dangerous to the mother that the child's welfare is of secondary importance. In severe cases of accidental hemorrhage the child is practically always dead, and in those of lesser severity the infant mortality is very great. In placenta previa, unless routine section is done, about 25 per cent of the children will not survive and even if section is done the mortality is still high. Three of our deaths occurred in cases of accidental hemorrhage. One was delivered by low forceps and autopsy revealed no cause of death. The others were normal deliveries and autopsies were not done. There were five deaths in cases of placenta previa, three patients were delivered by section. One had a normal delivery and autopsy showed only atelectasis. The other patients were delivered by version (transverse presentation) and a clinical diagnosis of intracranial hemorrhage was made.

From a consideration of this series of fetal and neonatal deaths, it would appear that the following views are justifiable.

1. A statistical consideration of birth injuries following any type of delivery is of little value unless accompanied by a study of all the clin-

ical facts in each case. For instance, the statement that a certain percentage of a series of fetal deaths followed forceps delivery is of little value unless we know whether there was any alternative method to forceps delivery and when and how the forceps were applied.

2. Some intracranial hemorrhage occurs frequently in so-called normal labors, and in many cases causes no symptoms.

3. Some patients having clinical evidence of such injury recover and present no evidence of permanent damage.

4. The incidence of severe injury increases with the length of labor and also with attempts to shorten labor by operative delivery from below.

5. The danger to the mother from cesarean section must not be forgotten when thinking of the danger to the child from vaginal delivery.

6. The increasing number of elderly primiparae and the desire for short and painless labors are factors in infant mortality at the present time.

7. Many serious injuries to the child are the result of either unwise or unskillful operative deliveries.

8. In many cases there is inevitable danger of serious injury to the child in a properly conducted labor; the conscientious obstetrician can only do that which he thinks is in the best interests of both mother and child.

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#### GYNOPLASTIC REPAIR FOLLOWING DELIVERY\*

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IT IS assumed that the duty of the obstetrician at the time of delivery is not only to prevent any unnecessary injury to the mother, but also to repair any injuries that cannot be prevented. Based upon this assumption, many opinions have been expressed as to the time and the extent of such gynoplastic repair. Personal observations lead me to believe that there must be an evaluation of the pathology, both as to type and extent; a knowledge of the nature and type of operative procedure required for a satisfactory result; and an accurate appreciation of the patient's condition, so that maternal mortality and morbidity will not be increased nor convalescence unduly delayed.

The discussion touches upon the following subjects:

1. Immediate and intermediate (5 to 10 day delay) repair of new injuries in a series of 300 cases.

\*Read at the Fiftieth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, Hot Springs, Va., Sept. 20 to 22, 1937.

2. Immediate repair of old injuries: (a) cervix and perineum in a series of 150 cases; and (b) cystocele, rectocele, cervix, and perineum in 20 cases.

These two groups are compared with a series of 150 cases with evidence of old injuries, but in which no repair was done.

In these cases, I have included none with known evidence of toxemia or infection prior to delivery, but have included normal deliveries as well as forceps and versions. All are hospital cases, where ample facilities and assistance are at hand to inspect each vaginal tract and carry out such operative procedures as are deemed advisable.

#### IMMEDIATE REPAIR OF NEW INJURIES

The first group of cases includes a group of 300 primiparae in 70 per cent of whom there was definite evidence of trauma varying from laceration of the cervix, vaginal wall, and vulva to perineal separation and episiotomy. The greatest number of cervical and vaginal wall lacerations occurred in posterior positions of the fetal head whether labor was terminated normally or by operative interference; next in order were breech deliveries, followed by versions and anterior positions.

Regardless of our individual belief as to the subsequent occurrence of malignancy in these lacerations, we do know that their neglect results in ectropion, ulceration, infection, chronic discharge, and irritation. For these reasons I believe the present-day attitude<sup>1</sup> of repairing all such injuries before the patient leaves the hospital is to be commended. However, the question arises as to when this repair should be done and how extensive an operative procedure should be carried out in the puerperal state.

In our experience, we have found in this series of cases that immediate examination<sup>2</sup> of the vaginal tract and repair of *new*<sup>3</sup> injuries to the cervix, vaginal wall, and the perineum yields satisfactory results in most cases. Cases in which examination was omitted fall mostly in three groups, viz., those in which the patient's general condition was unsatisfactory or dubious; those in which we had reason to doubt rigid asepsis; and those cases which manifested free bleeding from an atonic uterus.

#### INTERMEDIATE REPAIR

The intermediate operation<sup>4, 5</sup> after an interval of five to ten days was used in a limited number of cases, but we found that the psychologic effect on the patient was unfavorable; the exposure was less adequate; tissues, though less edematous, were still highly vascular and more friable; and we were disturbing a healing process that nature had already instituted.<sup>6</sup> The patient was subjected to a second anesthetic and her hospitalization prolonged eight to fifteen days so that economic advantages are lost.



Therefore for these reasons we have discontinued the delayed or intermediate type of operation, except in a few cases where there was a contraindication to an immediate operation or where there has been a breaking down of a perineal repair.

#### REPAIR OF OLD LACERATIONS AFTER DELIVERY

The second group of cases, viz., the repair of old lacerations and injuries resulting from previous deliveries, is more controversial and admits a greater diversity of opinion. For that reason it is well to enumerate (1) the various conditions found during pregnancy as well as immediately after delivery; (2) the various operative procedures carried out; and (3) a résumé of our end results both immediate and late.

The conditions<sup>7</sup> found most frequently are lacerations of the perineum, cervix, cystocele, urethrocele, rectocele, and varying degrees of procidentia. It is admitted that delivery is one operation and repair of these conditions is another, but one which requires time, care, and precision as well as the ability of the patient to withstand prolonged anesthesia, additional blood loss, possible shock and lowered resistance. The question arises, can operative procedures for the correction of all these conditions be carried out routinely, or, can only a limited type of repair, e.g., trachelorrhaphy and perineorrhaphy,<sup>8</sup> be carried out in selected cases?

Satisfactory end results are judged by the criterion of end results obtained from operations on the nonpuerperal patient. Economic advantages to the patient or the community do not justify mortality, morbidity or inferior end results.

As there was no mortality in this group of 150 cases of cervical and perineal repair after delivery, a comparison will be made with an equal group of 150 cases in which, for various reasons, no repair was made. These cases will be compared from the standpoint of morbidity, blood picture on admission and discharge, days of hospitalization and presence of nonfebrile complications, e.g., subinvolution, anemia, bladder and rectal complications.

At this time suffice it to say that there was a slight increase in morbidity, an average increase of two and one-half days of hospitalization, a definite though not serious change in the blood picture and an increase in the number of bladder complications.

#### REPAIR OF CYSTOCELE AND RECTOCELE

Before taking up the third group of 20 cases in which a more extensive type of repair was carried out, it is well to recall that cystocele is a hernia of the bladder through the anterior vaginal wall due to a separation of the supporting fascia. Likewise, rectocele is a hernia of the rectum through the separated posterior vaginal fascia and proper repair requires that this fascia be identified and united before closing the vaginal mucous membrane. In this case as in cystocele, we are dealing

with a thin fascial structure as compared with the thick fascia of the abdominal wall or elsewhere in the body. Furthermore as a result of delivery this tissue is distorted, shredded out, and friable, so that even though we know what we are looking for, in its distorted form, recognition is not always easy but even at times impossible. Due to vascularity exposure is less adequate, friability makes the tissues more difficult to handle after they are identified and such structures are hastily united without the careful precision that should be found in plastic operations.<sup>9</sup> It is readily conceivable that tissues distorted by pregnancy and traumatized by labor and delivery could be perforated in repair or show faulty anatomic union after involution has taken place.

In this small group of cases, we had 5 patients with cystitis and pyelitis and 4 with cystitis alone. Upon subsequent examination, there was still evidence of cystocele and urethrocele in 7 cases and in five cases there was definite evidence of rectocele. Hospitalization was increased to an average of twenty-one days; morbidity was increased and the blood pictures likewise showed an unfavorable comparison.

TABLE I. BLOOD PICTURE

	BEFORE DELIVERY			AFTER DELIVERY		
	R.B.C.	W.B.C.	HG	R.B.C.	W.B.C.	HG
N. R.*	4,091,000	12,300	82%	4,259,000	8,400	85.0%
P. R.	3,960,000	11,900	81%	3,850,000	8,900	77.5%
C. R.	4,000,000	12,800	83%	3,300,000	11,400	73.0%

\*N. R., No repair (150 cases); P. R., repair of cervix and perineum only (150 cases); C. R., cystocele, rectocele, cervix and perineum (20 cases).

Founded upon theoretical objections and substantiated by unfavorable immediate and late results in those few cases of extensive repair that I have been able to observe, my opinion coincides with those who favor the interval operation performed after the patient has recovered from her delivery and after involution is complete.

However in selected cases, where there was no contraindication in the patient's condition before delivery or especially *after* delivery, our results in repair of perineum alone, or cervix and perineum<sup>10</sup> show satisfactory anatomic results in 75 per cent of cases. That the end results are not universally good is evidenced by irregular hypertrophy and fistulous tracts seen in some cases. Experience and improvements in technique may, in time, further decrease the number of such unfavorable results.

#### PROCIDENTIA

Despite the fact that the cervix and perineum are properly repaired and the uterus pushed upward, by pressure above the symphysis, we often find on subsequent examination that these patients have varying degrees of procidentia. This I believe is due not so much to relaxation or subinvolution of the uterine ligaments, but rather to a destruction or

faulty anatomic union of the fascia supporting the lower parts of the uterus and upper vagina. That such fascia does offer the greatest support to the uterus seems established from experiments of the past few years. With this thought in mind various methods were used to temporarily hold the cervix in a relatively normal position until natural healing or coaptation was established. While no method is free from practical and theoretical objections, nevertheless, a rather simple one has caused the patient less discomfort, has been productive of no increased morbidity and has yielded fairly good results.

#### ELEVATING CERVIX AND SUPPORTING UTERUS

In cases where the cervix presents at the vulva or lies in the lower vagina, it is grasped with a ring forceps and the uterus is pushed upward with the hand above the symphysis. A large tubular packer is then used to insert 3 to 5 yards of gauze around the cervix and gently fill the vagina without protruding through the vulva. This packing is inserted firmly but not tightly as one would to control hemorrhage. The sponge forceps is then withdrawn and the pack allowed to stay in place for thirty-six to forty-eight hours.

This is not done in any case where the integrity of asepsis is doubted or where any previous infection was known to have existed. Likewise, it is not offered as a curative method for cystocele, rectocele, or procidentia, but just as predelivery emptying the bladder and rectum helps to avoid injury to these structures and their fascial supports, so also this procedure seems to have some merit in causing the fascia of the lower uterus and upper vagina to reunite in a more normal position.

#### TECHNIQUE

Preparation for repair of new and old birth injuries is really begun as early in the prenatal period as is found any evidence of infection or injury from previous deliveries. Cervical and vaginal infections are cleared up by appropriate treatment, and in the case of old injuries, the patient is told that if circumstances are favorable, after delivery, correction of certain conditions will be attempted. However, she is told of the possibility of the procedure not showing a perfect result, but we feel that, if the operative procedure is limited to cervical and perineal repair, a satisfactory result may be obtained in 75 per cent of the cases.

Immediately after delivery all instruments and utensils used in the delivery are discarded; new gowns and gloves are to be used and the patient redraped with sterile linen, after spraying with tinct merthiolate. The vagina is retracted either with a self-retaining weighted speculum or exposed with retractors in the hands of assistants. The cervix is grasped with four ring forceps and the entire circumference inspected. A gauze pack, with string attached, is inserted into the uterus to keep back any uterine bleeding. Any new laceration of 1 cm. or over is sutured and even smaller lateral lacerations are caught with one interrupted suture. In the case of old lacerations, the side with the deeper one is treated first and all previous scar tissue is excised both from the anterior and the posterior lip. As the anterior lip is usually thicker than the posterior the edges are trimmed so the surfaces to be approximated are nearly the same size. Then interrupted sutures of the chromic

catgut No. 2 are placed about 1 cm. apart starting from the upper angle and continuing to the external os. The opposite side is treated in the same manner. We have found better results since using a running suture in the mucous membrane, the first loop of which is placed deeply above the apex of the laceration, and then continued down the line of incision and over the end of the cervix for a distance of 1 cm. where it is tied. The pack is then removed from the uterus and the vagina swabbed with tinct merthiolate. The posterior vaginal wall is grasped at the mucocutaneous border with Allis' forceps and the scar tissue is excised. The vaginal mucous membrane is then dissected upward and levators exposed. All scar tissue is excised, and levators and fascia united by interrupted chromic catgut sutures. Excess mucous membrane is excised and the cut surfaces approximated as in the usual perineorrhaphy. Skin is closed by a subcuticular catgut or by interrupted dermal sutures.

If the cervix lies low in the vagina or protrudes at the vulva, the uterus is pushed upward and a gauze pack inserted loosely in the vagina. This pack, introduced with a tubular packer, is removed at the end of thirty-six or forty-eight hours.

If the patient is unable to empty her bladder she is catheterized every eight hours and irrigated with silver nitrate 1 to 10,000 once daily.

In exposing the cervix we avoid pushing the uterus down from above, as we believe this adds additional trauma to the loose areolar fascia supporting the cervix and upper vagina. Likewise, care must be used not to tear the cervix or pull it forcibly through the vulva so as to facilitate its suture.

#### COMMENTS

Delivery is one operation and gynoplastic repair another. The latter is a hospital procedure with many limitations to be carried out on selected cases with the aid of capable assistants observing rigid aseptic technique.

Recognition of gross cervical and perineal injuries is usually not difficult; exposure can be obtained with comparative ease without additional trauma; excision of previous scar or traumatized tissue is quickly carried out and fresh surfaces united by suture in a short time. The procedure cannot be carried out routinely, but is subject to many limitations, the most important of which are the general condition of the patient following delivery and the extent of the pathology. The primary object of the obstetrician is a successful delivery and no procedure which increases maternal morbidity and mortality can be condoned in this age of critical scrutiny.

That there are economic advantages in examination and immediate repair of certain injuries, one cannot deny, likewise many subsequent pathologic changes can be prevented. The anatomic results are not universally good and subsequent examinations at times show marked irregular hypertrophy of the structures repaired.

#### CONCLUSIONS

1. The vaginal tract should be examined after every delivery if there is no contraindication from the standpoint of asepsis or the general condition of the patient. New lacerations and injuries should be cared for at that time.

2. In selected cases and under favorable conditions immediately after delivery, repair of old cervical and perineal injuries can be carried out with little difficulty. The immediate and late results are usually satisfactory.

3. The immediate operation offers advantages from an economic and psychologic viewpoint, while the intermediate operation has the additional disadvantage of disturbing tissues that have already started to heal.

4. Extensive repair of cystocele, rectocele, and enterocele as well as cervix and perineum is an operative procedure requiring more time and precision than is advisable after delivery. Such operations should be delayed until the patient has fully recovered from her delivery and the tissues have undergone complete involution.

5. Repair of cervix and perineum do not prevent procidentia and uterine displacements. This can be done only by restoration of the fascial attachments in their normal relationship. Surgical restoration at this time is inadvisable and a simpler method should be sought. Loosely packing and distending the vagina with gauze following delivery seems to accomplish this in some cases.

6. Both the immediate and intermediate operations present technical difficulties not present in the interval operation, but if performed in selected cases and limited to the cervix and perineum can be commended as having definite advantages to the patient.

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#### DISCUSSION ON PAPERS OF DRS. KING AND SCOTT

DR. PALMER FINDLEY, OMAHA, NEB.—Let me say at the onset of my discussion that I have no quarrel with any man who obtains reasonably good results in adopting any operative procedure. Dr. King has demonstrated in his statistics that he can do just that. But what of the general practitioners who are doing the bulk of obstetrics? Can we expect of them equally good results? I think not. And if it be true that the extended repairs advocated by the essayist would be hazardous in the hands of the inexperienced operator, should this Association go on record as endorsing such a procedure in routine practice? It is scarcely conceivable that morbidity and mortality will not be increased if the methods proposed by Dr. King are accepted and practiced by the general profession, yes, and by the experienced obstetric surgeon.

In the first half of my professional career I endeavored to learn what to do, and now in the second half I am learning what not to do. To my way of thinking, a



woman who has given birth to a baby has done her good deed for the day, and no avoidable burden should be placed upon her. With this thought in mind, I would say to Dr. King, and to all who follow his precepts with equally good results, "You have proved your ability to get reasonably good results and are justified in continuing on." But to those less skilled, who are not so situated as adequately to safeguard their patient, I would say, "Be content with the repair of the fresh wounds in the pelvic floor and await the time of complete involution before proceeding with the repair of injuries to the cervix, of cystoceles, urethroceles, rectoceles, and procidentia." All this in the interest of better obstetrics.

DR. J. BAY JACOBS, WASHINGTON, D. C.—Figures bearing much resemblance to Dr. Scott's are those published this year by Küstner of the Leipzig Clinic. In the delivery of 7,319 children occurring in the last two years, 81.4 per cent were normally born and of these 3.8 per cent were stillborn or died during the first week. Of the children delivered by operative procedure, 16.2 per cent died.

As concerns the frequency of intracranial injury, Bland reported 27 per cent in which bleeding was present. Holland found laceration of the tentorium cerebelli in 48 per cent of cases examined. Occasionally bleeding does not accompany laceration. Prematures, whether delivered normally or operatively, are especially subject to intracranial damage due to weak blood vessel walls and incomplete development of meningeal fibers.

The production of intracranial injury is said to be due principally to factors that cause alteration in the shape of the skull.

In this respect it is instructive to cut a window in both parietal bones of a still-born fetus thus permitting the removal of the brain and enabling observation of changes occurring in the falx cerebri and tentorium cerebelli, when pressure is applied in the various diameters of the fetal skull. It is noted that these membranes are less liable to stretch and tear when transverse compression is applied, as in the cephalic application of forceps, than when pressure is applied obliquely. And when compressed in the anteroposterior diameter, little effort is required to stretch and rupture these membranes. Where vessels are not severed, the prognosis is more favorable.

A most noteworthy observation is brought to our attention by L. H. Smith of Portland who performed cisternal punctures in a large series of normal infants at birth as well as many who encountered some intracranial damage. Blood was found in the spinal fluid in both types, but its presence was of no prognostic importance, as was determined after a five- to seven-year follow-up of the mental and physical facilities of these children. He concluded that only the degree and character of the clinical signs and symptoms are important in arriving at a diagnosis and prognosis of birth injury.

In 1936 I reviewed several hundred case records, classifying them into normal, precipitate, and prolonged labors, and operative deliveries. Each of the patients had been delivered ten years before, of parents of approximately the same social status, age, environment, and intellectual capacity. Various intelligence tests were made on all these children, and it was found that all, regardless of the type of labor or delivery, rated about the same. Also the incidence of illness was similar for the two groups. Thus, there seemed to be no intellectual or physical retardation. It appears safe to assume, then, that only the major degrees of intracranial injury are liable to produce a mental or physical defect that remains permanent.

DR. RUDOLPH W. HOLMES, CHICAGO, ILL.—As regards primary repair, I believe there should be a survey of the whole parturient canal after each operative

intervention to ascertain what damage may have been done. Necessary repairs should be made. In the absence of hemorrhage, I have rarely sutured the cervical tears, other than very extensive ones. As regards secondary repair immediately following delivery, I took the stand thirty-five years ago that extremely rare circumstances should dictate such a procedure.

The parturient canal is teeming with bacteria. All the parturient tissues are in a state of physiologic congestion, comparable to the first stage of an inflammatory process. The canal is covered with innumerable minute abrasions, and veins and lymphatics are patent. Heedless manipulations may be the means of disseminating the bacteria with disaster.

Immediately post partum the parturient canal is a widely patulous cavernous tract. When involution has been completed, the canal becomes a perfectly physiologic and anatomic vagina. I question the ability of any one so to gauge a secondary repair immediately post partum that the woman will have a normal canal after involution is complete. I have had some instances of this post partum secondary repair of so-called cystocele and rectocele where the canal became so contracted that marital relations were impossible.

DR. KING (closing).—This is certainly not a procedure to be advocated routinely, or used in unfavorable circumstances, but under favorable conditions in hospital practice our results do justify the type of repair I have advocated. This I know is likewise the experience of many members of this Society, who have not only carried out but have advocated gynoplastic repair of old lacerations of the cervix and perineum for many years.

DR. SCOTT (closing).—It is quite obvious that if there is an indication for operative delivery there will be some difficulty and there will be more danger of damage to the child. If we are to do conservative obstetrics, we must accept some inevitable fetal mortality, for if we attempt to prevent that mortality by radical methods, for instance, cesarean section, then we shall have some maternal morbidity.

## SURGICAL TREATMENT OF OVARIAN DYSFUNCTIONS\*

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THE past few years have seen phenomenal changes in our conception of the functions of the various endocrine glands. Theoretically the ovarian dysfunctions have all been explained and appropriate medical treatment should correct the difficulty.

Unfortunately there are many patients who do not respond in any way to endocrine therapy, and it is a small series of these cases of which I am about to speak, and hope to stimulate some discussion on your part as to whether or not the surgical measures employed are to be considered justifiable.

\*Read at the Fiftieth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, Hot Springs, Va., Sept. 20 to 22, 1937.

We all encounter cases of ovarian hypo- or hyperfunction associated with the presence of ovarian tumors, especially retention cysts. Some of these are thin walled, may be easily ruptured by bimanual pressure, or the function may be restored by aspiration of the contents of the cyst through the cul-de-sac.

My interest in the surgical treatment of ovarian dysfunctions, other than those associated with ovarian tumors, was aroused by a clinical and pathologic study published by the late M. R. Robinson of New York, in 1935. At this time he presented 7 cases, 4 of ovarian hyperfunction and 3 of hypofunction, in all of which he obtained gratifying results by resecting the major portion of both ovaries, in a wedge-shaped manner.

Robinson's explanation of the beneficial effects obtained is as follows:

"In ovarian hyperfunctions the morphologic changes in the sex gland and in the endometrium represent the effects of the pituitary hyperstimulation with follicle-ripening hormone. The character and degree of the morphologic responses varies with the phase of the dysfunction. A surgical removal of a sufficient amount of ovarian parenchyma harboring an excess of morphologic and biologic elements responsible for the existing functional disturbance, permits the pituitary to regain its intraglandular balance and thus a restoration of a normal pituitary-ovarian correlation."

He also maintains that in ovarian hypofunctions the reverse holds good. "Here the luteinizing forces of the anterior hypophysis play the leading rôle. The inhibitory effect of the ovary in this type of dysfunction is upon the already weakened follicle-ripening properties of the hypophysis. A removal of sufficient amount of ovarian parenchyma containing these disturbing elements helps in the restoration of a normal intrahypophyseal balance, and thus a return to a normal pituitary-ovarian correlation." He maintains there is a pattern to the pathological changes which is uniform in character.

A review of the literature reveals very little material on this subject, except that presented by Robinson.

After reading this report it occurred to me that I had seen a number of cases of ovarian hypofunction, in which the ovaries were frequently small and very tender, which I thought might have been benefited by excision of the thickened ovarian cortex without destroying the parenchyma. Those patients had not had the advantage of modern endocrine therapy. That phase of our treatment is even now of inconstant value, i.e., the methods of treatment are not entirely standardized. Furthermore the results obtained by endocrine therapy are not always what one might hope for.

The excision of a large segment of ovary in the treatment of hyperfunction may be considered justifiable. However, with one exception I have limited my surgical treatment of these patients to those showing evidence of hypofunction at the time of operation. However, two of these had presented the picture of ovarian hyperfunction on previous occasions.

### The operation consists of the following:

The ovary is grasped at either pole by Allis forceps, and the cortex incised longitudinally from one end to the other, for a depth estimated to be sufficient to extend through the width of the thickened cortex. The cortex is then taken off the parenchyma by sharp dissection, denuding a half or two-thirds of its surface. Bleeding is somewhat annoying, and is controlled by means of mattress sutures of 00 plain catgut, not unlike the method of obtaining hemostasis in a subtotal thyroidectomy. No attempt is made to bring the cut edges of the cortex into approximation.

If the ovary is somewhat prolapsed, as it often is, it is suspended by means of a reef stitch of chromic gut, taken in the ovarian ligament, or the organ is loosely attached to the fundus. Care is taken that no interference is caused in the ovarian blood supply.

### CASE REPORTS

CASE 1.—Mrs. C. L. (University Hospitals), aged twenty-one years, para i. This patient first came under my observation July 19, 1927, complaining of one-child sterility. General examination showed a short obese woman, weighing 180 pounds. She had had one child born three years before this date. She further complained of a gain of weight of 40 pounds in three months' time and that menstruation occurred every seven or eight weeks, free and without pain, but she had some dull pain in the left side of her lower abdomen.

Examination showed the uterus to be large and boggy and the left ovary large, polycystic, and tender. In September, 1927, dilatation and curettage were performed at Lakeside Hospital; at this time a Rubin test was positive. After this she continued to have pain in the cystic left ovary and was given twelve very light doses of x-ray to the ovary which was then advocated, but without relief. Severe nosebleeds followed this. In 1928 she reported that her menstrual periods were more regular, but the pain was persistent and had become bilateral. In August, 1929, she reported no menstrual period for the previous six months. Basal metabolic rate was -4 per cent at this time, she was given intensive gland therapy and placed on a diet for obesity.

She was next seen in December, 1934, then twenty-eight years of age, weighing 170 pounds, complaining of spotting or actual bleeding constantly, for six months. On Jan. 5, 1935, a dilatation and curettage were performed at Lakeside Hospital. The pathologic diagnosis was hyperplasia of the endometrium. She had continued to have pain in both ovaries, but upon examination they were not large. A month later she reported no vaginal bleeding but had had a nosebleed twice a day. Regular menstrual periods followed until July, 1935, when they ceased.

In February, 1936, her basal metabolic rate was -20 per cent and she was given intensive endocrine therapy, but her pains continued. On May 6, 1936, operation at Lakeside Hospital consisted of a diagnostic dilatation and curettage, excision of the cortices of both ovaries, and incidental appendectomy. At the time of operation the ovaries were 5 by 4 by 3 cm., studded with many tiny cysts thought to be immature Graafian follicle cysts; two-thirds of the cortex of each ovary was removed. On April 10, 1937, the patient reported she was feeling better than she had for many years, had lost 19 pounds in weight without intensive dieting, and menstruated in moderate amounts six days of each month and had no more ovarian pain. On Sept. 7, 1937, she reported she was feeling fine; menstrual periods as above noted.

CASE 2.—Mrs. A. C., age twenty-three years, nullipara, married three years. This patient was first seen April 9, 1936, giving a history of severe pain in the lower

abdomen which had been decidedly worse in the previous two days. The menstrual history was that she had menstruated slightly every two or three months since childhood, with some pain.

Examination showed the presence of a cyst of the right ovary; the uterus was small and firm. She was admitted to Lakeside Hospital April 10, 1936, with the diagnosis of ovarian cyst with dysfunction. At operation a chocolate cyst of the right ovary approximately 5 cm. in diameter was found; right salpingo-oophorectomy and incidental appendectomy were performed. Inspection of the left ovary showed it to be small, with a very thick cortex; almost the entire cortex was excised and the ovary suspended. There were small cysts present in the ovary without evidence of recent ovulation. She last reported on Aug. 30, 1937, that her menstrual periods were now every twenty-four days, lasting three or four days, and without pain.

CASE 3.—Mrs. L. S., aged thirty-two years, para ii. This patient was first seen in consultation, March 12, 1932, complaining of irregular bleeding since the birth of her second baby, Nov. 5, 1931. Examination showed some relaxation of the vaginal outlet, the uterus was in slight retroversion, both ovaries moderate in size and very tender. The uterus was brought into place and a Smith pessary inserted. Two days later she menstruated, with a severe hemorrhage, and four days after this was admitted to Lakeside Hospital, complaining of severe pain in both ovaries; the ring had been removed. She was treated with bed rest, douches, and tampons; examination showed the right ovary to be irregularly enlarged and exquisitely tender. March 21, 1932, the polycystic part of the right ovary was resected. July 19, 1932, four months later, this patient was again seen with her family physician, now having very severe pain in her left ovary, requiring opiates for relief. A long series of antuitrin-S and other gland therapy followed this procedure. Pain in the left ovary persisted without reference to ovulation, and the patient became a semi-invalid.

Examination April 24, 1935, almost three years later, showed the left ovary to be small, polycystic, and extremely tender. She was readmitted to the hospital at that time, and the left ovary was exposed through a left gridiron incision. The ovary was found to be polycystic but small, the cortex was resected and the patient made an uneventful recovery. On Aug. 28, 1937, this patient reported that she menstruated regularly, in moderate amount, and had no more ovarian pain.

CASE 4.—Mrs. F. H., aged thirty-eight years, nullipara, married twelve years. This patient was seen Sept. 6, 1936, complaining of amenorrhea, sterility, and general malaise. Her last menstrual period had been in 1926. Examination showed a small atrophic uterus; ovaries likewise very small. She was given an intensive course of theelin therapy, also thyroid by mouth. She was admitted to the University Hospitals, Nov. 3, 1936, and was operated upon the following day. A dilatation and curettage were performed, with the insertion of a small stem pessary. Upon opening the abdomen, both ovaries were found to be atrophic, with greatly thickened cortices, almost cartilaginous in structure. The cortices were excised. She made a normal recovery. She was placed on emmenin and theelin therapy but had not menstruated to date. However, she says that she feels better than she has for many years. She is still receiving endocrine therapy.

CASE 5.—Mrs. R. K., aged thirty years, nullipara, married seven years. This patient was first seen Oct. 4, 1933, complaining of sterility. She gave a history of menstruating every ten to twelve months. She had been given fourteen injections of theelin and antuitrin-S without results. Physical examination showed a small, healthy woman; however, she had a male type pelvis and male hirsutes. Pelvic examination showed the left ovary slightly large and tender. Basal metabolic rate was -1 per cent. She was placed on small doses of thyroid and pituitary extracts and ten days later had a slight menstruation. She had a slight show in November,



1933, none in December and developed headaches. In February, 1934, a stem pessary was inserted in the uterus. Sixteen days later the patient had a normal menstruation and her headache stopped. The pessary was removed February 26 because of excessive bleeding. On June 30, 1934, the patient reported there had been no menstruation since the stem had been removed, so we replaced it. Her next menstrual period was November 17, five months later, and on Dec. 3, 1934, the stem was again removed. On March 30, 1935, the patient reported no menstruation since November, 1934, and complained of severe pain in the left ovary, present for two weeks. Examination at this time showed the left ovary enlarged and very tender. She was admitted to Lakeside Hospital, March 31, 1935, and on the following day April 1, dilatation and curettage and stripping of the capsule of the ovaries and incidental appendectomy were performed. She made an uneventful recovery from the operative procedure and menstruated twenty days after the operation, freely and without pain, for three days (April 20). She again menstruated May 30 and July 12 and reported she felt better than for many years. She menstruated August 30, September 30, and November 5 and continued at thirty- to thirty-five-day intervals until April 30, 1936. July 22, 1936, examination showed her to be two months pregnant. She was delivered March 1, 1937, by low cervical cesarean section, of a living male baby, at full term. Section was done because of the male type pelvis in which the head had not engaged. At this operation both ovaries were inspected and a small omental adhesion separated from the left one. A very thin bluish cortex had re-formed on both ovaries. At this time she had been married eleven years.

On Aug. 23, 1937, this patient reported that she now menstruated every thirty-five days, freely, and has no more ovarian pain.

CASE 6.—Mrs. A. S., aged twenty-three years, para i. This is a case of hyperfunction at the time of operation, in which a modification of the aforementioned operation was employed.

She was referred to our service for therapeutic abortion from the Tuberculosis Sanatorium of the Cleveland City Hospital, on May 5, 1936. She was then two months pregnant, and therapeutic pneumothorax treatment had been instituted. The abortion was performed, and she was later discharged to the Out-patient Department.

She at no time had had any evidence of tuberculous disease other than pulmonary. She gave a menstrual history of frequently missing menstrual periods since their onset, at the age of fifteen years. She was readmitted to the sanatorium Sept. 10, 1936, and had begun to menstruate. This became very free, in spite of intensive treatment with antuitrin-S and ergotrate, and on September 30 a dilatation and curettage were performed. Hyperplasia of the endometrium was found.

She was seen in the Out-patient Department on April 4, 1937, with the history of prolonged and irregular menstruations following the dilatation and curettage. She had then been bleeding constantly since Feb. 28, 1937. Examination showed the uterus very small, and anterior, both ovaries large and very tender, especially the left.

She was readmitted to the Hospital April 27, 1937, still bleeding, and on May 3 was operated upon. This consisted of a dilatation and curettage, resection of a segment of each ovary, and decortization of approximately two-thirds of the remaining portions. She made an uneventful recovery. Therapeutic pneumothorax therapy had been continued throughout this time.

She reported July 20, 1937, that her menstrual periods were now regular every thirty days, lasting seven days. Examination now shows both ovaries small and no longer tender.

The pathologic report of this case noted the presence of large numbers of tiny follicle cysts in the excised ovarian tissue.

## PATHOLOGY

Robinson maintained that there are definite morphologic changes linked with the functional changes in all cases of long standing.

A careful pathologic study of the material removed in our five cases of decortization for hypofunction was made by Dr. Robert Faulkner. He summarizes his findings as follows:

On pathologic examination of the ovarian tissue removed, three characteristics were common to all except one. First, thickening of the tunica albuginea; second, increased fibrosis of the ovarian cortex; third, follicles in all stages of development and atresia.

Where curettings were available, normal physiologic phases prevailed with no particular phase predominating. One endometrium was of the "Swiss cheese" hyperplasia gland pattern. In the ovarian findings of follicles and fibrosis, there was one exception, a persistent corpus luteum with cystic dilatation.

Therefore, these cases show no absolutely constant histologic features in the ovaries. Such characteristics as are present are in general almost opposite those catalogued in cases of ovarian hypofunction by Robinson. Inability to definitely classify ovarian findings in the dysfunctions seems logical for the reason that seldom is any dysfunction purely ovarian in character, but only a part of the general endocrine derangement.

## SUMMARY

I have presented five cases of ovarian hypofunction, with ovarian pain, all of whom were benefited by excision of one or both ovarian cortices. Another case, of hyperfunction with pain has apparently been relieved functionally and subjectively by excision of part of each ovary, combined with almost complete decortization.

Surgical treatment of ovarian dysfunction should have a very limited field of usefulness, but it is my opinion that there is a place for it if we are to utilize all the facilities at our command. Many of these patients become actually psychic, due to almost constant pain, and with their inordinate fear of the consequences of abnormal sex functions.

Partial decortization alone appears to be beneficial in relieving ovarian hypofunction, and pain.

Excision of a segment of ovarian parenchyma, usually without decortization, may be beneficial in some obstinate cases, in dealing with hyperfunction.

A combination of the procedures might be undertaken if ovarian pain accompanies hyperfunction.

I realize that the cases presented are not complete from the standpoint of an endocrinologist, and his criticism might be that they were not adequately treated from a medical standpoint. Furthermore the number of cases is too small to warrant definite conclusions. However, I present them for your discussion and judgment.

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## DISCUSSION

DR. WILLIAM H. WEIR, CLEVELAND, OHIO.—Dr. Reycraft's concluding remarks, that there is a limited field in surgery for these dysfunction cases, sum up the situation. The fact that Dr. Reycraft has obtained satisfactory results shows that his cases were adequately studied, suitable patients selected for operation, and endocrine treatment thoroughly tested beforehand.

My own results when I undertook abdominal operations for such conditions were usually bad. The temporary results might be good but they were not lasting. We formerly were accustomed to puncture follicle cysts, to split the ovarian capsule, or to resect a piece of ovary. These operations would permanently benefit an occasional case but the average case was improved only temporarily. A great many of them were made definitely worse because we had then not only a polycystic ovary for example, but an adherent one as well.

I cannot quite reconcile in Robinson's article, which Dr. Reycraft quotes, the removal of ovarian tissue for conditions due both to supposed hypofunction and also hyperfunction. I gathered from the paper that the purpose of the operation was simply to remove a certain amount of ovarian tissue so that the balance between the pituitary and ovarian reactions would be more normal. If that is the case, it would seem simpler to remove part of, or the whole of, one ovary, and allow the other ovary to remain untouched, thus lessening the danger of postoperative adhesions. On the other hand, is the operation done with the intention of removing the unduly thickened cortex in the hope that the new scar tissue that replaces it will be less dense and so permit the rupture of follicles, developing in the underlying area?

In these patients we should be very conservative, especially if retention cysts of the ovary be present. Many individuals come to me, after they have had immediate abdominal operation advised. In the interval of a day or more between the examinations of the original physician and of myself, a large follicle cyst, for example, may have spontaneously disappeared. These cysts of the ovary should be treated conservatively and watched for a while, for the follicle type of cyst will seldom need operation.

DR. FRED M. DOUGLASS, TOLEDO, OHIO.—One point I would like to bring up is the morbidity that follows leaving a raw surface. Regardless of the care taken in raising the ovary out of the pelvis, difficulty will follow any such procedure. I believe this morbidity must be weighed in analyzing or summarizing the end results.

The few treated in this way shows that Dr. Reycraft is not attempting operation upon every patient with ovarian pain. I am sure that he does not want to leave that impression. I would like to have Dr. Reycraft speak a little further on the late results if he has observed any of these patients over a long period of time.

DR. T. K. REEVES, PITTSBURGH, PA.—Dr. Reycraft has stated that some of these cysts are thin walled, may be easily ruptured by bimanual pressure, or the function may be restored by aspiration of the contents of the cyst through the cul-de-sac. Is it justifiable to rupture a pelvic mass without knowing the exact nature of the mass? Probably many here, in removing the uterine tubes, have inadvertently en-

croached upon the blood supply of the ovary, causing an enlargement of the organ. If this occurs within a reasonable period of time, the reason for the increase in size is presumably known. This is the only instance in which bimanual rupture might be excusable, even though it is not without attendant danger. I have seen in fact a case in which this procedure was accomplished so successfully that the patient had to be subjected to abdominal section in order to stop the hemorrhage from a corpus luteum cyst. Aspiration through the culdesac is likewise a dangerous procedure on account of the possibility of disseminating malignant cells. We all know that the grade of malignancy in an ovarian cyst does not depend upon its size or age.

Dr. Reyeraft stated that after denuding one-half to two-thirds of the ovarian cortex, no attempt was made to approximate the cut edges. In this respect may I mention the value of a free omental graft. It prevents the adhesion of intestine to the line of excision, as well as the adherence of the ovary to the parietal peritoneum or a pelvic viscus. It in no demonstrable manner interferes with ovarian function.

PROFESSOR DANIEL DOUGAL, MANCHESTER, ENGLAND.—I am particularly interested in Dr. Reyeraft's paper because two years ago one of my colleagues, Dr. K. Vernon Bailey, reported a series of cases of secondary amenorrhea treated by splitting or "extroversion" of the ovaries. His paper was received with a good deal of skepticism and I personally thought that in some of the cases menstruation would have returned spontaneously without any surgical treatment.

More recently, Bailey read a further communication and claimed that he was able to cure 70 per cent of, I think, 20 cases. One of the patients with a history of two years amenorrhea menstruated regularly for a few months after the operation and then became pregnant. These were astonishing results and the discussion on Bailey's paper was on similar lines to the one we have had today. Bailey's method was to split the ovaries and stitch them in such a way that the two halves were left opened out, with the raw surfaces directed downward toward the floor of the culdesac where presumably they became adherent. This appeared to be a somewhat crude procedure but was evidently quite successful.

The ovaries treated were either cystic or had a thickened cortex. I confess that I am rather skeptical when I read about the ovarian cortex being thickened and I would like to know what standards the pathologists apply when determining this fact. It is claimed that these operations facilitate ovulation but I think that the results must be due to stimulation of functional activity by traumatizing the ovary.

Dr. Reyeraft's methods and results come as a shock to those of us who believed that with increased knowledge of physiology the treatment of ovarian dysfunction was becoming more logical, and must be taken as an indication that the pendulum is swinging back again. This may not be a bad thing if it helps us to realize that ovarian function can be restored by other methods than endocrine therapy.

DR. REYCRAFT (closing).—My first objective in this work was merely to remove a mass of thickened cortex so that the follicles could get out more easily. The effect may be a purely mechanical one. I also do not accept Robinson's claim that the same operation should be done for both hypo- and hyperfunction.

There is a real danger of adhesions, as Dr. Douglass has mentioned. We did try to control all bleeding with sutures without interfering at all with the adequate circulation of the organ.

I do not come here advocating bimanual rupture of ovarian cysts, but I have merely cited cases where dysfunctional conditions of the ovary were corrected after the rupture of a cyst.

## TREATMENT OF VESICOVAGINAL FISTULAE\*

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VESICOVAGINAL fistula is of infrequent occurrence at the present time. Phaneuf<sup>1</sup> estimates that it occurs once in ten thousand gynecologic and obstetric cases. The small number of cases treated by any one clinician makes it hard to arrive at definite conclusions and a perfect operative technique, and the operative treatment is so frequently unsuccessful that a consideration of the handling of this distressing condition may not be out of place.

### ANATOMIC CONSIDERATION

The anterior vaginal wall is about 7.5 cm. in length. The posterior vaginal wall is about 10 cm. long. The female urethra is 3.75 cm. in length. The ureteral openings are 3 cm. from the bladder neck or internal urethral opening.

The length of the urethra, plus the length of the bladder neck to the intraureteric ridge or top of the trigone is 6.75 cm. which leaves about 1 cm. of bladder wall in approximation to the anterior vaginal wall above the trigone.

After panhysterectomy, at least from 0.5 to 1 cm. of vaginal wall has been amputated. That would bring the remaining vaginal vault on the level of the trigone and ureteral openings.

As a postoperative fistula nearly always occurs at the point where the vagina is amputated, that fistula is then in close proximity to the ureteral openings. And, if it is not in the median line, it is in close proximity to the ureteral opening on the side nearest the fistula. Occlusion of the ureter by suture or undue kinking may happen very easily (Case 1).

There is one other anatomic factor worth considering. The vaginal wall is a modified skin, of tough structure, with very little muscle tissue. It is about 0.5 cm. thick. The bladder wall is a muscular organ and in its collapsed state is 1 to 1.5 cm. thick. There is very little fibrous tissue in the bladder wall and so it is not prone to form much cicatricial tissue. The vaginal skin is very fibrous and forms the same type of scar tissue as the skin on the outside of the body.

### CYSTOSCOPIC EXAMINATION

When the fistula is small and the bladder can be distended with fluid, cystoscopy can be done without any difficulty. But when the fistula is large and the fluid introduced into the bladder runs out of the fistulous opening as fast as it is introduced, cystoscopy is impossible. To overcome this, the vaginal introitus can be infiltrated with 1 per cent procaine solution and a subcuticular suture of heavy silk or linen is taken around the entire vaginal outlet and tied very tightly to make the vagina watertight. Proper preparation of the bladder and the vagina should precede this method of cystoscopy. If infection exists, the bladder should be irrigated daily with a saturated solution of boric acid

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and a vaginal douche of 1:3000 solution of permanganate of potash should be given twice a day until the infection is reduced. The use of mandelic acid internally may be of great assistance, as many of these organisms are very rapidly overcome by this drug (Braasch<sup>2</sup>).

Just before cystoscopy is begun the bladder is irrigated with boric acid solution and a bivalve speculum is introduced and the vagina dried out, taking care not to cause bleeding from the sensitive bladder mucosa that protrudes through the fistula. Then the introitus is closed with the subcuticular suture. A bladder that has been decompressed over a long period of time will be hard to distend, but as the bladder and vagina are distended together, the fistulous opening can be viewed and if the ureteral orifices can be seen, No. 6 ureteral catheters should be passed if possible. A phenolsulphonephthalein function test is then done to note the comparative kidney function. If the ureteral openings cannot be visualized, an intravenous dose of indigocarmine is given and its excretion watched for from both ureteral orifices. If this is found to be unsatisfactory, an intravenous urography should be done. If only one kidney is functioning, and that on the same side as the fistula, the probabilities are that the ureteral opening is in close proximity to the fistula and the greatest care must be taken not to constrict the ureter at operation.

If it is possible to insert catheters in the ureters, they should be left in situ and an operation performed within twenty-four hours.

#### METHODS OF REPAIR

I have had no experience with transvesical or transperitoneal repair. Both of these methods may have their place in certain types of cases and have resulted in success after several vaginal route failures. The one advantage pointed out by Sears<sup>3</sup> in the transvesical operation is the possibility of ureteral catheterization at the time of operation, and the care that can be taken by this method to prevent ureteral obstruction. However, Everke<sup>4</sup> operating by this method failed to put catheters in the ureters and tied both of them. Uremia developed and the patient died.

The principles that were adopted by Kelly, A. Martin, and Mackenrodt simultaneously in 1890, and since by Ward, Rawls, Phaneuf, Norman Miller, Halban and others, of extensive exposure of the fistulous area, mobilization of the base of the bladder and correct suturing, seem to have replaced the Sims classical operation and give good results.

In the ordinary moderately sized fistula, adequate exposure is necessary. If the vagina is relaxed and the fistula can be brought into view easily, it may be repaired without episiotomy, perineotomy, or Schuchardt's incision. If a median perineotomy is sufficient to give ample exposure, this is preferable for it is easy to repair. If the perineum is tight and the vaginal vault roomy, a mediolateral episiotomy will give a good exposure. In a contracted and small vagina, like we meet at times after radium irradiation, an extensive Schuchardt's incision carried well up into the vaginal vault is preferable. The fistulous tract is picked up with

Allis' clamps and excised with a scalpel. This as a rule gives a better denudation than trying to excise with scissors. The elasticity of the bladder wall can then be tested by picking it up separately with Allis' clamps and drawing it together. Most of the scar tissue will be found in the vaginal skin. The vaginal wall is then separated from the bladder wall, mostly by blunt dissection. If the vaginal wall is very adherent to the bladder wall, Ward's method of incising the vaginal wall some distance from the fistula and dissecting toward the fistula is preferable. Most of the time, if the patient has not had a previous operation, the vaginal skin is easily mobilized from the bladder wall and may be incised either longitudinally or transversely as it may seem best. The vaginal wall is dissected off the bladder wall for a sufficient distance to allow closing the bladder wall with three layers of sutures. The suture material that we use is No. 00 extra hard forty-day chromic catgut, generally on a small full curved atraumatic needle. The first layer is taken through the bladder wall submucosal and is of the cross-stitch type. Any inversion of the mucosa into the wound will defeat the result. Two more layers build up the bladder wall to produce more tissue to heal together. This inverts the fistula into the bladder. If a leak should occur later, this gives a better chance for the fistula to heal spontaneously. The vaginal wall is then closed with a layer of buried sutures, catching the bladder wall to leave no dead space. The last layer closes the vaginal skin together with No. 0 chromic catgut. I can see no advantage in using silver wire to close the vaginal skin. If the bladder wound heals, the vaginal skin will heal regardless of the type of suture used. Halban<sup>5</sup> is also of this opinion. We have had no experience with alloy stainless steel wire permanent sutures, and in these days of clean catgut it would seem unessential to bury foreign bodies where they might ulcerate into the vagina or bladder.

#### TOTAL COLPECTOMY

For the treatment of a large fistula at the vaginal vault in an old woman, either after hysterectomy or irradiation, total colpectomy and closure of the fistula is a good method.

The technique is best carried out under local infiltration of procaine. The fistulous tract is picked up and excised. The vaginal wall is then dissected away and the fistulous opening in the bladder is closed. The entire vaginal skin is then removed and the cavity is closed by numerous purse-string sutures down to the introitus. This procedure can only be done where the cervical canal is completely closed from irradiation or after a panhysterectomy (Case 2).

A subtotal colpectomy, Le Fort operation, could be done where the uterus is still in and in the place of leaving two lateral gutters for drainage, one would be sufficient.

#### MECHANICAL ABRASION

When the fistula is so small that it causes a leaking but the patient voids by urethra a fair quantity, a cystoscopy is done and a ureteral catheter passed through the fistulous tract into the vagina for several inches, then the catheter is caught in the vagina and quickly drawn through. A catheter that is slightly rough from age or repeated sterilizations is preferable. A fresh abrasion heals more readily than a chemical or thermic burn. There is no reason for cauterization, electrocoagulation or caustic chemicals being used in this type of case, only a fresh abrasion is justified (Case 3).

## DRAINAGE

For the ordinary fistula well above the bladder neck, the indwelling Pezzar catheter kept in from seven to ten days is sufficient. Where the fistula is low down near the bladder neck, a plain catheter sutured in as suggested by Phaneuf is the desired method. When the patient has had repeated operations which have resulted in failure, a suprapubic cystotomy, with a large Pezzar catheter No. 30 or larger sutured in, is a satisfactory method of drainage.

As the intravesical pressure is the same in all directions and there is no pool of urine but a closed sac full of fluid, the position of the patient in bed is of no consequence. The essential thing is to see that there is no kinking of the drainage tube or catheter and that there is no pull on the catheter to cause discomfort to the patient or to pull the catheter out of the bladder.

The following case illustrates the importance of preoperative urologic study with cystoscopy and intravenous urography.

CASE 1.—M. M., forty-three years old, colored; admitted to hospital Jan. 17, 1936. She had had a panhysterectomy and bilateral salpingo-oophorectomy for fibroids and chronic pelvic inflammation six months before, by one of my assistants. She had a vesicovaginal fistula 0.5 cm. in diameter to the right of the median line in the vaginal vault. There was no preoperative urologic study done. The laboratory findings were normal except for a slight increase in the total blood urea of 39 mg. in 100 c.c. of blood. She was operated upon Jan. 22, 1936, under local infiltration of 1 per cent solution of procaine. The usual technique was carried out. She drained only 10 ounces of urine the first twenty-four hours. The next day she was acutely ill with a temperature of 105.5° F. and complained of pain in the right side of her abdomen and right loin. The resident was instructed to have a cystoscopy done and if the ureters could not be catheterized, to remove all sutures and allow the fistula to open. An emergency blood chemistry was ordered. Being encouraged by a slight increase in drainage, the cystoscopy was not done and the wound not opened. The blood chemistry showed urea 70, creatinine, 2.05, sugar 84. She was getting a saline elysis of 1500 c.c. and an intravenous infusion of 300 c.c. of 25 per cent dextrose solution daily. The elimination continued poor and on the fifth postoperative day she showed marked nitrogen retention, urea 181, sugar 228, and creatinine 2.85. A cystoscopy showed an irritable bladder, the ureteral openings could not be visualized and indigocarmine was not excreted in fifteen minutes. A flat x-ray of the abdomen showed both kidneys normal in size and position with no opacities. Uremia was evidently developing and the sutures were removed and the fistula allowed to open on the sixth postoperative day. An intravenous urography showed no excretion of the dye in either kidney. The patient died the next day of uremia.

Of course, this case was poorly handled. When signs of uremia began to develop and the output was not in proportion to the intake, all the sutures should have been removed. The kidney function is completely destroyed by total obstruction in from forty-eight to seventy-two hours and if the obstruction is not removed until after the function has been destroyed, it is of no avail. Evidently this patient was living on her right kidney and during the repair the ureter was obstructed. The left kidney probably had no function previous to operation. That could have been determined by a thorough preoperative urologic study.

The following case illustrates total colpectomy in a large fistula in an old woman after radium irradiation.

CASE 2.—L. M., sixty-four years old, colored widow, had had irradiation of Roentgen rays and radium for carcinoma of the cervix a year previously. She was admitted with the carcinoma completely healed, the cervical canal completely imperforated, and a large vesicovaginal fistula 1.5 cm. in diameter at the vaginal vault. A cystoscopy was attempted but was unsatisfactory as the filling solution ran out as fast as introduced. Suturing the vaginal outlet did not occur to us then. She was operated upon under local procaine infiltration. An extensive mediolateral episiotomy gave ample exposure. The usual technique was carried out and after the bladder was repaired the entire vaginal wall was removed and the cavity closed with numerous purse-string sutures. A Pezzar catheter was inserted in the bladder and left in for twelve days. She made an uneventful recovery.

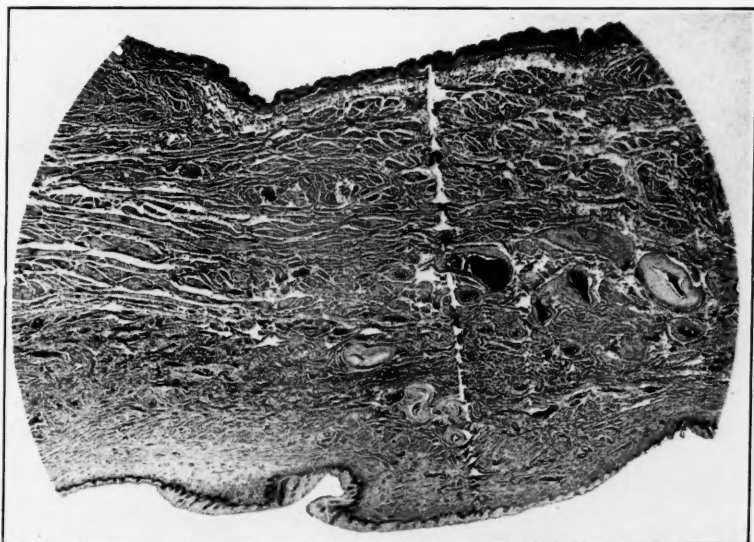


Fig. 1.—A section taken through the bladder wall and the anterior vaginal wall above the trigone,  $\times 12$ . Above is the bladder mucosa with several layers of transitional epithelium. The longitudinal, circular, and oblique muscle bundles of the bladder wall are lying in a soft fibroelastic bed. Below is the modified skin of the vaginal wall with its dense structure and covered with its thick squamous epithelium. Between the bladder wall and the vaginal wall are many large blood vessels and nerves.

The following case illustrated the value of mechanical abrasion of a small vesicovaginal fistula.

CASE 3.—C. C., forty-seven years old, white woman, had had a vaginal hysterectomy for adenocarcinoma of the corpus uteri two months previously. She was admitted with a small vesicovaginal fistula 0.5 cm. in diameter at the vaginal vault. It was repaired with the usual technique, and she was discharged from the hospital on the tenth postoperative day with the fistula healed. About a month later she began to have a slight leaking of urine from the vagina. She was advised to return for a second repair but refused. After two years I succeeded in getting her to come to my office for a cystoscopy. The bladder wall was normal; on the intraureteric ridge a small fistula was seen having almost the appearance of a third ureteral opening. A

catheter was passed through the fistula into the vagina. Not wanting to withdraw the catheter through the bladder for fear of infection it was picked up in the vagina and quickly drawn through. A few days later, the fistula healed.

#### CONCLUSIONS

1. The bladder wall is far more elastic than the vaginal wall, and contains so much muscular and elastic tissue that the scar tissue in vesicovaginal fistulae is mostly confined to the vaginal wall.
2. After hysterectomy or irradiation most fistulae are in close proximity to the ureteral openings.
3. Cystoscopy should precede operation, the ureters should be catheterized and kidney function tests be done, including intravenous urography.
4. A method of cystoscopy in fistula cases has been described.
5. Free mobilization of the bladder from the vagina is essential.
6. After thorough repair of the bladder wall, the method of closing the vaginal skin is unimportant.
7. Complete or partial colpectomy is applicable to large fistulae.
8. Mechanical abrasions should be tried in small fistulae before resorting to operation.
9. Suprapubic bladder drainage is advisable in patients who have had repeated operations or where the fistula is near the bladder neck.

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#### DISCUSSION

DR. LOUIS E. PHANEUF, BOSTON, MASS.—Where the bladder cannot retain fluid for a cystoscopic examination the Kelly endoscope used in the knee-chest position may render great service. Without too great difficulty, the ureteral orifices may be located, the ureters may be catheterized and the visualization of the relationship of the fistulous area may be accomplished. This instrument, which was in common use up until twenty-five years ago, should not, in my opinion, be entirely abandoned.

The importance of the renal function test is obvious when we realize that most of the surgical fistulae follow difficult panhysterectomies, and because of the inaccessibility of the deep structures about the cervix, the ureter of one side or the other is not infrequently inadvertently tied. The proximity of the vesicovaginal opening to the ureter in surgical fistulae has been brought out in the paper.

In the nulliparous woman with a small introitus and narrow vaginal tube, I have found that bilateral episiotomies gave better exposure than a single incision, no matter how extensive, on only one side. The free mobilization of the bladder, as pointed out, may be obtained by large vaginal incisions longitudinal and transverse. Occasionally, a combination of the two may simplify the approach.

I am a strong partisan of the metallic suture, having used silver wire up to 1935 when I learned from Dr. W. Wayne Babcock of the greater advantages of the alloy



suture. Since that time, I have used the alloy suture with great satisfaction and I am firmly convinced that I have closed difficult fistulae with metallic sutures that I could not have closed with catgut. Thus far, I have not seen ulceration in the bladder and vagina as the result of their employment.

Since reporting 10 personal cases of vesicovaginal fistula at our 1935 meeting I have operated upon 3 others, making a total of 13. The first had a supracervical hysterectomy for pelvic tuberculosis; the right ureter had been tied and the bladder had been injured at operation. She had had one attempt at closure before she came to consult me. She was operated upon suprapubically, reaching the bladder extraperitoneally. The portion of the bladder removed histologically showed tuberculous cystitis. As might be expected, my repair which held for a few days was not successful. Her left kidney shows good function and I intend to close her vagina at a later date.

The second was a large obstetric fistula. The bladder was closed with the finest alloy sutures and the vagina with coarser ones, which were removed, healing taking place by first intention.

Finally, the third patient, a nulliparous woman with a small introitus and narrow vagina came to me from another state for a fistula which had immediately followed a panhysterectomy for fibroids. By means of bilateral episiotomies, free mobilization of the bladder, alloy sutures in this organ and the vagina, I was able to obtain primary healing. This patient was operated upon four weeks ago.

DR. NATHAN P. SEARS, SYRACUSE, N. Y.—A fistula is not often due to incision in the bladder but to traumatization with subsequent sloughing. This is indicated in the lapse of time between the original operation and the appearance of leakage.

I wish also to emphasize the use of the Kelly instrument. I do not think any gynecologist is satisfactorily equipped to view the inside of a bladder without it. With this we do not have to rely upon fluid to distend the bladder. Catheterization of ureters should be universally done in patients with large fistulae.

I have not used malleable wire in bladder fistulae, but I have had a very beautiful result in an old complete perineal tear by using the alloy suture, the case having once failed in its repair.

DR. DUNCAN (closing).—The Kelly endoscope can, I agree, be used for ureteral catheterization in a bladder that will distend with air under ordinary atmospheric pressure with the woman in the knee-chest position. In these fistula cases, however, the bladder has been decompressed for so long that it has become contracted and, even with the vagina closed with suture, it is hard to distend the bladder under water pressure to hold more than two ounces. It may be possible that the ureteral openings cannot be visualized and one must resort to an indigocarmine test to watch for its excretion. All this takes time and it is very uncomfortable for a patient to remain so long in the knee-chest position. I think the water filled bladder and a regular cystoscope will be found more satisfactory.

## PELVIC TUBERCULOSIS\*

JAMES E. KING, M.D., BUFFALO, N. Y.

**D**URING the past ten years, definite progress has been made in our knowledge of tuberculosis. A number of factors has contributed to the present decrease in infection and increase in cures. These are: a better understanding of juvenile tuberculosis and its significance in adult pulmonary and extrapulmonary infection; the earlier diagnosis of pulmonary infection; the value of sanitarium treatment; surgical procedures and principles in the treatment of pulmonary cases, and the education of the public in the importance of hygiene and in the dangers of contact with pulmonary tuberculosis.

Tuberculosis may affect any organ or tissue of the body and, like syphilis, it thus possesses an interest for every practitioner and every specialist. Inasmuch as pelvic tuberculosis is known to constitute from 5 to 8 per cent of all cases of pelvic inflammation, its importance to the gynecologist is obvious. No practitioner or specialist should essay to treat any form of tuberculosis unless he is familiar with the more recent advances in our knowledge. The purpose of this paper is to investigate some of these in order to determine which may be applied to the better understanding of the etiology, diagnosis, and treatment of tuberculosis of the pelvis.

A new interest was stimulated in tuberculosis in 1882 by the discovery of the tubercle bacillus. Since that time, a voluminous literature has accumulated. The majority of contributions have appeared in French and German, relatively few in English.

The development of a comparatively safe operative technique has made it possible for the gynecologist to understand the gross pathology, and to study clinically both early and late cases of pelvic tuberculosis. There is still much uncertainty in diagnosis, and a failure on the part of some surgeons to appreciate the significance of certain phases of its etiology upon which are based the principles that should govern its treatment.

### ETIOLOGY

For a number of years, a lively discussion has been going on as to whether pelvic tuberculosis is, or ever can be, a primary local infection, or whether all cases of vaginal and cervical tuberculosis, together with uterine and tubal involvement, are to be regarded as a secondary infection from a primary focus in some other part of the body. Much argument, speculative and theoretical, and many case histories, have been

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brought forward in support of possible primary infection. Those who oppose this view, cite the extreme rarity of such vaginal and cervical infection, even in long-standing cases of extensive pulmonary tuberculosis, where opportunity for the introduction of infection is always present. Norris<sup>1</sup> feels, as do others, that the infrequency of such local infection is due to the protective character of the vaginal epithelium, but admits the possibility of infection in the case of injury to the vaginal or cervical epithelium.

Jameson,<sup>2</sup> in a monograph published in 1935, reports two series of experiments to establish the possibility of primary infection. The procedure in his first series was to insert pledgets of cotton, saturated with a virulent strain of tubercle bacilli, into the vaginas of 12 normal guinea pigs. The tampons were placed in ten of the animals during estrus, at which time the vagina is believed to be more susceptible to infection. The tampons were retained in the vagina for several days by lightly applying a Michel clip. At the end of one hundred days, the animals were autopsied and the regional lymph nodes and the genital organs were studied carefully. In only one animal did there appear any genital tuberculosis, and that was a lesion of the cervix. This one and four others, however, showed definite lymph node invasion. Feeling that somewhat different results might be obtained in sensitized animals, 15 guinea pigs were sensitized by injecting tubercle bacilli into the axillary glands. After allowing several weeks to elapse, bacilli were introduced into the vagina by the same method as in the former series. In this latter group of animals, the results were quite different. Nine of the guinea pigs showed submucous lesions of the vagina, 4 lesions of the cervix, and 1 a large abscess of the uterus. Jameson states that these results were strikingly like those obtained by Granzou in similar experiments. From these findings he concludes that an occasional primary infection of the vagina and cervix may occur, at least in sensitized individuals, but that a primary infection ascending to the uterus and tubes must be exceedingly rare. While the possibility of primary infection of the vagina and cervix may be admitted, it is generally accepted that intrapelvic infection by the tubercle bacillus is always blood borne.

Naturally, many have attempted to discover the presence of the bacillus in the blood. Weichselbaum in 1884 found the bacilli in smears of postmortem blood clots. In 1908, Stäubli<sup>3</sup> and a number of other Germans searched for the bacillus in hemolyzed blood and in 1909 several German investigators claimed to have an almost 100 per cent success in smears from sedimented blood of tuberculous patients. These methods and results failed to find general acceptance.

Attempts to recover the germs from the blood by culture were also made, but Wilson,<sup>4</sup> writing in 1933, was able to collect only 6 undoubted instances of successful blood cultures up to 1929. In 1930, Löwenstein<sup>5</sup> of Vienna revived interest in blood cultures by reporting the results he obtained in many thousand specimens of blood. He claimed a surprisingly high percentage of positive cultures. These positives he described as "macroscopic" and "microscopic." His work aroused a new interest in bacillemia, and a number of investigators attempted to confirm Löwenstein's findings. The results were varied—so varied indeed, that grave doubt was expressed. So many failed to duplicate his findings that in 1930 Löwenstein<sup>5</sup> felt called upon to devote an article to setting forth the reasons for these failures. Siegel and Singer,<sup>6</sup> following the Löwenstein technique, were able to obtain macroscopic cultures in 1.4 per cent of 911 specimens from 422 tuberculous persons. The macroscopic cultures were proved to be virulent bacilli. Their 13 per cent of microscopic cultures obtained were not proved to be cultures of the tubercle bacilli. This is possibly accounted for by the fact that it has long been recognized that there

are many sources of contamination by strains of acid-fast, nonpathogenic bacilli found in plants and animals (Rabinowitsch<sup>7</sup>) and in the air and water (Brem<sup>8</sup>) that cannot be differentiated by smear from the tubercle bacillus.

Corper and Vidal<sup>9</sup> approached the problem from the experimental side. They injected virulent strains of human, bovine, and avian bacilli into the blood of guinea pigs, rabbits, dogs, and chickens. They found that the injection of high concentrations of 1.00 mg. into the blood stream of a susceptible animal invariably produced death within a month, and at all times the bacilli could be recovered from the blood. When, however, the same bacilli in the same dosage were injected into animals that were not susceptible, the bacilli disappeared from the blood stream within a few days following the injection. It was also found that upon injections of the more attenuated doses, 0.001 to 0.000,001 mg., the bacilli disappeared promptly from the blood stream even of susceptible animals, although these doses might produce a generalized tuberculosis. These investigators conclude that there is no evidence for the belief that tubercle bacilli multiply in the blood. They also believe that when the tubercle bacillus finds entrance into the blood stream of man, it will, as a rule, disappear quickly, and that the various forms of surgical tuberculosis are to be regarded as embolic implantations of the bacilli. It would appear that these views coincide with what is known clinically of genital tuberculosis.

This conception of blood borne infection in surgical tuberculosis at once arouses interest in the possible location of a primary focus. It is generally conceded that such a focus is most frequently in the lung. The relative infrequency, however, of bone, kidney, cerebral, and genital involvement in sanitarium patients manifesting all degrees of pulmonary involvement, would cause one to wonder why surgical tuberculosis does not occur with greater frequency in these patients.

Greenberg,<sup>10</sup> in his review of 200 cases of pelvic tuberculosis, quoted autopsy findings upon tuberculous women by various European observers who found from 1 to 8 per cent with pelvic involvement, while Stopper found 20.5 per cent and Posner 30 per cent.

The discrepancy in these percentages raises a question as to the reliability of some of the observations. In various reports dealing with series of cases of pelvic tuberculosis, only about 25 per cent have had demonstrable evidence of pulmonary involvement. I found that in my 26 cases of the past twelve years, 6 gave evidence of pulmonary tuberculosis. It is clear that the extent of pulmonary involvement plays at most but a small part.

Inasmuch as practically all pulmonary cases show regional lymph node involvement, these glands offer a second possible source of bacteria. It would seem that, in the number of cases of pelvic tuberculosis showing no demonstrable evidence of pulmonary invasion, the primary focus in a considerable proportion originates in the bronchial lymph nodes. Whether found in lungs or lymph nodes, however, it may be assumed that either the bacilli enter the blood stream only as a result of some comparatively rare combination of circumstances, or that if the bacilli do enter the blood stream frequently, they disappear, as has been shown, before embolic implantation takes place.

The possibility that a tubal infection may result from the spread of a tuberculous peritonitis, or that a peritoneal involvement may arise from tuberculous tubes, are questions that clinicians are willing to concede.

The figures with reference to the frequency of involvement of the various pelvic organs show the tubes to be infected in about 100 per cent of the cases. Any discussion of the subject, therefore, centers about the tubes. In the majority of instances, infected ovaries have only surface implantations. The percentages of ovarian infections vary within wide limits. Such infection is practically always secondary to that of the tubes and, associated with it, involvement of the peritoneum is usually found.

In determining the frequency of uterine tuberculosis, postmortem studies of patients dying of pulmonary tuberculosis afford an opportunity for histologic study in every case. In statistics from operations on pelvic tuberculosis, the figures vary in different clinics depending upon how many patients were curetted, or upon how many uteri were removed and examined. The generally accepted figures place the frequency of uterine tuberculosis at about 50 per cent.

#### DIAGNOSIS

The preoperative diagnosis of tubal tuberculosis has always been recognized as being extremely difficult and, in many instances, impossible. It is unfortunate that diagnosis of early involvement of the tubes cannot be made, for I believe that early recourse to the accepted, present-day treatment of pulmonary tuberculosis would heal the early tubal lesions equally well.

The signs and symptoms of tubal tuberculosis have been frequently reviewed but no sign or symptom is found that may not be associated with other forms of pelvic inflammation. The history of the pelvic complaint will therefore help little in reaching a diagnosis. Occasionally the pain of tuberculosis may be more constant than that of gonorrheal salpingitis. This fact was brought out several times after the pathologist had made the diagnosis. The leucocyte count may be suggestive, as it is found to be lower than in similar pathology due to the gonococcus. In our experience, loss of weight is usually not present and many of the patients have shown no general effects of their pelvic pathology.

The findings on pelvic examination also give no evidence suggesting tuberculosis. Untreated tubal tuberculosis is a progressive disease and, due to this fact, various types of pelvic pathology may be found. All of these types, however, may also be met with in other pelvic infections. Frequently, even inspection of the tubes at operation will not suggest tuberculosis.

There are apparently no pathognomonic symptoms, nor any specific findings upon which to base a definite diagnosis. If a diagnosis of pelvic



tuberculosis is made, it is only presumptive in the majority of instances. There are, nevertheless, a number of indications which, if sought for, may suggest very strongly the probability of tuberculosis.

The first essential necessary in making a diagnosis of pelvic tuberculosis is for the surgeon, when dealing with pelvic infection, to always keep in mind that pelvic tuberculosis can and does occur. This is self-evident, and though frequently mentioned, it may again be emphasized. In any case in which the cause of the inflammation is not determined with reasonable certainty, the surgeon should be suspicious of tuberculosis. With this suspicion in mind, he is better able to elicit facts in the history and to undertake studies that may prove to be of distinct value in suggesting the diagnosis of tubal tuberculosis.

We have often found that, had a more careful inquiry been made into the past history of the patient rather than focusing too closely upon the pelvic symptoms, much that would have been suggestive might have been learned. The history of previous pulmonary infection or a possible pleuritis is of great importance; the association with one who has tuberculosis, and finally frequent coughs and colds, may all be significant.

A careful chest examination should always be made and, in the absence of physical findings, x-ray plates, read by an expert in their interpretation, should be resorted to. Here it must be remembered, however, that a patient with chest signs may well have a gonorrheal salpingitis, and that one with evidence of gonorrheal endocervicitis may have a tuberculous salpingitis.

The positive skin tests for tuberculosis unfortunately give no clue as to the location of the lesion. With the decreasing number of reactors in the past ten years, the significance of a positive reaction has some weight in the probability of pelvic tuberculosis and a negative test definitely excludes it.

A review of recent studies of tuberculin skin tests indicates that considerable progress has been made. Many studies in the past few years have been undertaken upon children to determine the influence of their association with adults having tuberculosis. Incidentally, much has thus been learned of the relative value and the delicacy of reaction shown by the various tests.

There are three tests that have been extensively used and certain facts concerning them should be known even by those not especially interested in pulmonary tuberculosis. When Koch developed his "old tuberculin" it was used as a diagnostic agent and also as a "cure" for tuberculosis. Its use as a cure was quickly abandoned, and it was finally used only in diagnosis by means of the Pirquet scratch test. This proved to be somewhat crude. It was sufficiently definite, but was not a quantitative test. The Mantoux test is at present the one most frequently employed. It is used intradermally and its advantage lies in the possibility of accurately

determining the amount of tuberculin to which the individual will react. It may be used in varying dosage. A 0.001 mg. dose will usually elicit a reaction to an active tuberculosis. Should it not, a 0.01 mg. dose may be tried, reaction to which will always indicate the presence of tuberculosis.

A still more recent test is the use of purified protein derivative, the so-called "P. P. D." test. It is supplied in one-fourth grain tablets of two strengths, 0.0002 mg. and 0.05 mg. These tablets are soluble in the salt solution supplied with them, and varying strengths can thus be prepared. Incidentally, it is of interest to note that during the two-year period from June, 1934 to June, 1936, 56,688 individuals were tested with purified protein derivative, and positive reactions were found in 47 per cent. This is a marked decrease from the 70 to 80 per cent of a few years ago. Purified protein derivative will doubtless be the choice for future tests for tuberculosis. It is intradermal and possesses all the advantages and none of the disadvantages, such as sensitization, of the other tests.

About the time Löwenstein reported his blood cultures, he proposed a skin test. It consists of the soluble substance of the tubercle bacillus, extracted with glycerine, and the whole dead bacillus. The skin is cleansed and a drop of this testing agent is rubbed in. A positive reaction consists of a nodule at the site of the inoculation. In a reactor, the nodule will appear in from twenty-four to seventy-two hours. This test is not as delicate as the Mantoux and Pirquet tests. Fine,<sup>11</sup> who did a comparative study of the three tests, concluded that, while the Löwenstein test is not as delicate as the other two tests, a reactor to it is certain to have an active tuberculosis and in his opinion it qualifies that individual for sanitarium treatment. Is it possible that such a test, being less sensitive, would be of greater value in surgical tuberculosis than the more sensitive ones?

#### TREATMENT

There are many excellent articles to be found on the surgical treatment of tuberculous salpingitis. It is not the purpose of this paper to discuss these, but I do wish to emphasize some points in connection with the surgery and treatment of tubal tuberculosis. I am convinced that no patient should be operated upon in the presence of fairly well-marked pulmonary involvement. This is not so much because of any objections connected with surgery itself, but because in such cases the pelvic pathology is the less serious of the patient's infections. Three or four weeks in a hospital following operation may result in extension of the pulmonary process. Radical surgery is seldom required. An ovary should be removed only when abscessed, or when it is infiltrated with tuberculosis. The surface implantations may be ignored if proper post-operative treatment is carried out. The adhesions associated with pelvic tuberculosis are so dense that, as a rule, no line of cleavage is found as

in other infections. Freeing adhesions necessary for removal of the tubes is done by sharp dissection; all others are left undisturbed. Where pus is encountered, rubber tube drainage is always used. Drains were employed in 8 of my 26 cases, and no fecal fistula followed. The sinus that may follow can always be cured by appropriate measures. Finally, I am firmly convinced that every case of pelvic tuberculosis, regardless of how successful surgery may have been, should be followed by sanitarium treatment with heliotherapy. It is surprising how casually this most important part of the treatment is mentioned, if mentioned at all, by those who discuss treatment. This feature is most essential, and should always be strongly emphasized. It is unfortunate that sanitarium treatment consumes so much time, but at present there is no substitute. Following operation, the patient should be moved as promptly as possible to such an institution. The general condition of the patient will improve rapidly. A sinus, if present, will heal. What is still more important, it is the only means of healing the primary focus that has supplied the bacilli. For this latter reason, if for no other, such treatment is imperative.

It is much easier to persuade the poorer patient to undergo treatment because many of the sanatoria are maintained for those unable to pay. It is often difficult to convince a married woman that she can leave her home responsibilities. There are many arguments which, if stressed, will seldom fail to persuade a reasonable patient of the need to eliminate any remaining pelvic infection and to calcify and render innocuous the primary focus from which the infection spread. In my 26 cases here mentioned, all patients were urged to enter a sanitarium for further treatment. Fourteen acted upon this advice. One went to her home state where she spent several months in a sanitarium. Thirteen went to the city institution near Buffalo. Most of those who followed this advice were ward cases who could avail themselves of free treatment. A number of private patients and a few ward cases, for one reason or another, refused to go. A patient with a discharging sinus very seldom requires surgery. These patients with the evidence of their active infection constantly before them are easily convinced that further treatment is necessary. If the necessity of such postoperative care were more generally emphasized, less difficulty with other patients would be experienced.

#### SUMMARY

Progress in knowledge of tuberculosis for the past few years is reviewed in explanation of some problems of etiology.

Diagnosis is still difficult. A few suggestions are offered and the relative value of the skin tests considered.

Some views gained from experience in treatment of 26 patients in the past twelve years are presented with emphasis upon postoperative sanitarium treatment.

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## DISCUSSION

DR. E. MACD. STANTON, SCHENECTADY, N. Y.—The very word "tuberculosis" carries with it the concept which comes to us from our experience with pulmonary tuberculosis. This concept has been confirmed by our experiences with joint tuberculosis, renal tuberculosis, and intestinal tuberculosis. When, however, we come to study tuberculosis of organs not immediately exposed to complicating secondary infections or to mechanical or chemical trauma incident to their normal activities, we are compelled to assign totally different prognostic values to infections caused by the tubercle bacillus.

To illustrate this point, let me refer to lymph gland tuberculosis. One hundred and seven personally operated cases of lymph gland tuberculosis, mostly of the cervical lymph nodes, were traced for an aggregate of 1,348 postoperative years, or an average of 12.6 years per patient. This study showed that only 4 out of the 107 had ever developed any clinically recognizable pulmonary tuberculosis. In fact, almost all of them had completely recovered. The experience of the group had thus been decidedly better as regards the development of serious forms of tuberculosis than the normal expectancy for unselected groups subjected to an equal number of years of exposure.

In a similar study of 12 cases of mesenteric gland tuberculosis discovered at operation, I was able to trace the patients for a total period of over 120 postoperative years, or an average of ten years for each case. These patients were all alive and well. Not one of them had developed any serious form of tuberculosis.

In my experience tuberculous salpingitis has been relatively much rarer than the figures quoted by most authors. In a series of 502 operations for grossly demonstrable salpingitis, I have encountered only 8 cases of tuberculous salpingitis or only 1.6 per cent.

DR. ROBERT D. MUSSEY, ROCHESTER, MINN.—Tuberculosis of the female genital organs is essentially a condition amenable to surgical treatment. However, I want to report briefly one patient who recovered without surgical measures. This young woman, a nurse, unmarried, twenty-four years of age, had a cervical polyp removed two months before coming under our care. Three or four days following removal of this polyp she had a chill, rather severe pain in the pelvis, and two or three weeks later a large amount of pus drained through the rectum spontaneously. The pain continued and when we saw her she complained of a low-grade fever, which she had recorded herself, and pelvic pain. The menstrual periods had not been disturbed. On examination the preliminary diagnosis was of a pelvic inflammatory lesion involving the left tube and ovary. Physical examination and x-ray examination of the lungs did not show any tuberculosis. Our attention was called to the possibility of some other condition by the rectal examination which revealed about 10 cm. from the anus an ulcer in the anterior wall of the rectum, which was craterlike with rather firm borders. She was subjected to a proctoscopic examination, and the tissue removed was reported as tuberculous. She was subjected to another proctoscopic re-

removal of tissue, because we doubted the diagnosis and this was also reported as tuberculous. In the meantime some material was injected into guinea pigs and they died of tuberculosis. The sedimentation rate was rather rapid, and it was thought best to give Elliott vaginal heat and not to subject her to surgery. At the end of three months the mass had subsided to such an extent that she was given another series of Elliott heat treatments. The mass subsided further following this and examination about a year later revealed a residual mass of thickening. She is apparently well now. I am not presenting this as a method of treatment in pelvic tuberculosis, but merely as a case which may be regarded as one of tuberculosis of the genital tract which subsided without surgical measures.

DR. F. S. WETHERELL, SYRACUSE, N. Y.—About three months ago a patient was sent to me from a tuberculosis sanitarium because of a profuse vaginal discharge. On examining her I discovered a lesion of the cervix such as I have never seen before. It was a sharply demarcated, eroded area about 1 cm. in diameter with a serpentine edge, absolutely distinct from the squamous epithelium surrounding it. The squamous epithelium looked perfectly normal, while this area was a bit darker and had the appearance of the red plush on the backs of these chairs. The report on a biopsy specimen was tuberculosis of the cervix. This is the only case of tuberculosis of the cervix that I have seen. The treatment which I suggested was the use of the quartz light. It is a rather difficult procedure to insert the light on the cervix.

DR. HERBERT E. SCHMITZ, CHICAGO, ILL.—We have at the present time at the Cook County Hospital in Chicago three patients with primary tuberculous lesions of the cervix. They have all been under observation for over two years. One patient has a complicating myoma the size of a three months' pregnancy, one has a syphilitic gumma, and the third perfectly normal pelvic organs. We have not submitted these patients to any form of treatment other than to instruct them in general hygiene and a nourishing diet.

The interesting point is that two of these patients return to us with the ulcerations completely healed, and the squamous epithelium apparently intact, but if we remove a piece of tissue for biopsy we still get a positive diagnosis from the pathologist. The other has begun to spread rapidly on to the vaginal wall and we have sent her to have x-ray therapy tried.

DR. FREDERICK H. FALLS, CHICAGO, ILL.—An interesting condition of the pelvis from the standpoint of differential diagnosis is actinomycosis of the ovary. Last year at the Cook County Hospital we had such a case which developed from a tuberculous salpingitis. The lesion appeared on one side, the opposite tube remaining completely free, a finding noted by other operators. The lesion is not like a tuberculous salpingitis but is more like a massive gonorrheal salpingitis. Of course, if the lesion breaks down, the sinus that forms shows the typical sulphur granules, but in dealing with a chronic infection of the pelvis which appears to be a diverticulitis or a unilateral salpingitis, this condition of actinomycosis must be considered.

DR. JOE VINCENT MEIGS, BOSTON, MASS.—We have had at the Pondville Hospital one patient with tuberculosis of the cervix who also had pulmonary tuberculosis.

Why is it necessary to operate on pelvic tuberculosis at all? Might these patients not get well by being sent to a sanitarium without operation?

DR. J. R. GOODALL, MONTREAL, CANADA.—I have two interesting records that I would like to detail. Years ago a child of sixteen years was brought to the hospital with a large mass in the abdomen. She had no symptoms. When the abdomen was opened, the two Fallopian tubes were enormously distended, practically



filling the lower abdomen. There were no adhesions present. Both tubes were removed and the patient made an uneventful recovery, and is alive and well today. The microscopic section showed undoubted chronic tuberculous salpingitis. This case is presented to show what extensive lesions one may find without involvement of the peritoneum.

I should like to detail another case showing that a tremendous involvement of the pelvic structures may lie dormant for many years without producing symptoms, and then may relight under conditions of stress. About six months ago, a woman of twenty-eight years motored from Vancouver to Montreal with her husband, on their wedding trip. When she arrived in the vicinity of Montreal, she was brought to the hospital and exhibited signs of an acute abdomen. At operation a large mass in the right pelvis was disclosed, which later turned out to be an old tuberculosis, which had been primarily in the tubes, but had ruptured into the right broad ligament. The pelvis was cleared out, leaving a large cavity in the right broad ligament encrusted with old tuberculous calcified material. Drainage was established from below.

The early history of this second patient was interesting, for it showed that she had had pelvic trouble when she was thirteen years of age, and was invalidated at that time for a period of over a year. The process had quieted down, and she had been free from symptoms for fifteen years, carrying this large amount of tuberculous material in the broad ligament. The long trip, and the injuries of marriage, had brought about a secondary infection with an acute abdomen. The healing after operation was at first kindly, but two days before she was ready for discharge, a small sinus developed, which gradually enlarged and extended nearly the whole length of the incision. The discharge became very profuse, and a fistula developed. At the end of three months the patient died of inanition. She had overcome the secondary infection, but relighted the tuberculosis.

DR. KING (closing).—Unsuspected tuberculosis associated with other pelvic lesions is an interesting problem. In my series tuberculosis was found to complicate three fibromas, a large pseudomucinous cyst, and an endometriosis. A routine curettage disclosed two more cases of tuberculous endometritis.

I am entirely in favor of treatment without surgery if these patients could be diagnosed early enough. Unfortunately we cannot diagnose the early cases and the vast majority seem to require operation for the diagnosis.

Only rarely can sinuses be closed by surgery, but they yield readily to sanitarium treatment. The inexperienced surgeon will do repeated operations on these patients with sinuses. In one patient, a surgeon made three attempts to close a sinus, which healed after six weeks' sanitarium treatment.

The effect of sanitarium treatment is shown by the fact that the uncomplicated cases averaged a gain of 3.8 pounds per month and were soon discharged. The patients having extrapelvic tuberculous lesions do not have such rapid weight gain and require longer sanitarium care.

## Editorial

### Calcium Needs During Pregnancy

**I**N RECENT years the attention of both the obstetrician and his patient has been directed to the need of calcium, phosphorus, and vitamins during the antenatal period. No one can doubt that such attention to these dietary essentials has improved prenatal care in this country, especially as the average American diet, demonstrated by Sherman<sup>1</sup> many years ago, is often deficient in calcium. On the other hand, many unwarranted claims for calcium, phosphorus, and vitamin therapy have been advanced.

It is well established that the normal adult requires a minimum of 0.45 gm. and an optimum of about 0.7 gm. of calcium a day. During the last trimester of pregnancy the calcium requirements are increased to probably about 1.5 gm. per day. Absorption of calcium, in the form of soluble salts, which are formed only in an acid medium, occurs in the small intestines. In order to accomplish this, calcium may be taken in the form of milk at meals, or as calcium salts no nearer meals than four hours after and one hour before.<sup>2</sup> Furthermore, should there be no exposure to sunlight, vitamin D is essential to its utilization.

Calcium therapy undoubtedly relieves the muscular cramps that may occur during pregnancy. However, there is no evidence to assume that calcium administration prevents dental caries,<sup>3</sup> a condition for the prevention and cure of which we must still rely on proper dental hygiene and care. Furthermore, there is some evidence to show that too much calcium and vitamin D may lead to early calcification in the fetal bones (osteosclerosis).<sup>4</sup> As to the calcification of the teeth of the offspring, this, of course, is postnatal and does not depend on the ingestion, in addition to an adequate diet, of calcium and phosphorus by the mother.

It may be claimed safely that during pregnancy all calcium and phosphorus requirements are supplied by an adequate diet, containing these elements as well as the other dietary essentials. Certainly, any deficiency in these two elements, in the diet, may be corrected by the addition of milk, an easily assimilable source of these substances. The practice of instructing all pregnant patients to take one quart of milk a

<sup>1</sup>Sherman, H. C.: *Chemistry of Food and Nutrition*, New York, 1911, Macmillan Co., p. 289.

<sup>2</sup>Bernheim, Alice R.: *Med. Woman's J.*, March, 1937.

<sup>3</sup>Report of Council of Pharmaceutics of American Dental Assoc., *J. Am. Dental Assn.* 23: 139, 1936.

<sup>4</sup>Brehm, Wayne: *Ohio State M. J.* 33: 990, 1937.

Finola, George C., Trump, Ruth A., and Grimson, Mozelle: *AM. J. OBST. & GYNEC.* 34: 955, 1937.

day, especially during the last two trimesters of gestation, appears to be sound and to meet all requirements for calcium and phosphorus. Should it be necessary, because of dietary deficiencies, inability to drink milk, or lack of sunshine, to supply compounds of calcium and phosphorus and vitamin D, these must be administered with care, certainly in respect to vitamin D, as overtreatment may be as injurious as the deficiency itself.

H. J. Stander.

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## Correspondence

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### Photographic Records of the Cervix Uteri

To the Editor:

Sir,

With reference to the communication of Messrs Bruner, Rosebrook and Cushman in your recent issue (34: p. 1027, 1937), may I say that good photographs of the cervix have been published by Max Cheval (*J. Belge de Gynec. et D'Obst.*, July, 1914) and by Herbert R. Spencer and E. A. Barton ("A Speculum-Camera," *Proc. Roy. Soc. Med.* 9: p. 17, 1915-16). In the Speculum-Camera the speculum and the camera are combined, no separate stand being required as described in the other communications.

Yours truly,

HERBERT R. SPENCER, M.D.

London, Eng.

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To the Editor:

In response to an article printed in *Medical Record*, March 3, 1937, written by Abner Weisman and Charles Yerbury, I would like to make the following statements:

First, the test is new, for a perusal of the work done by Porges and Pollatschek (with a hormonal substance) was done with a substance that necessarily would be very different from the antuitrin-S of 1936 and 1937. Loeser's work was done with the urine of pregnant women and not with the refined substance that we used. A letter from Loeser himself complimented us on our work, and also stated that he would carry out further work, when, and if he was able to obtain the product we were using, because with an unrefined substance, he felt that his results were accurate enough to justify further work with a refined product.

Dowell and Deutsche's work was a repetition of Porges and Pollatschek's experiments. So it does not count either for the same reason.

We are quite aware of the stand taken by the American Medical Association. They are also being misled by the early product of antuitary extract, instead of the derivatives of today.

As to the length of time for reading the reaction. Weisman and Yerbury erred in not reading the test in the thirty minutes. We did not stress six to eight hours in our report because we had made the same observations that they did, and proved to ourselves that the thirty-minute period was the time to record results. A great number of our nonpregnant patients showed an erythema at the end of one hour, which we

are not attempting to explain, and quite a few of our nonpregnant controls showed a complete loss of erythema at the same time. Thus the thirty-minute period was established for the observation. Before submitting the test to unknown cases, checks on 100 controls were made, thereby learning to read the reaction. It is yet 100 per cent in our hands.

Again the above-mentioned authors took a great deal of liberty in interpreting our statements. We did not recommend it in place of the Aschheim-Zondek, but did and still are proving it more sensitive, and still recommend it for its rapidity. Since our paper appeared, we have diagnosed and have operated upon twelve unruptured ectopics, and have reports of three more. Since the original paper, we have tried antuitrin-S that was considered by the manufacturer as impotent, and have found the same results as with the fresh product. This we feel is due to the fact that the active principle is apparently a protein; whether or not it carries with it activity, it remains of the same character, and is specific; therefore, it would be expected to show the same reaction in sensitized subjects. Because of the above assumption, it may never be (as suggested by Yerbury and Weisman) crystallized or synthetically produced. If crystallized, it certainly would be, as all other similar products have been, very irritating at the site of injection. Again, we defend the word new, for the substance which we used is new.

G. C. GILFILLAN, M.D.

*Dayton, Ohio,  
April 21, 1937.*

# Department of Maternal Welfare

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CONDUCTED BY FRED L. ADAIR, M.D., CHICAGO, ILL.

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THE AMERICAN COMMITTEE ON MATERNAL WELFARE, INC.

ANNUAL MEETING, JUNE 9, 1937

Atlantic City, New Jersey

CHAIRMAN'S ADDRESS

FRED L. ADAIR, M.D., CHICAGO, ILL.

THE objectives of The American Committee on Maternal Welfare have been outlined at previous meetings and in publications which have appeared from time to time. Some of our chief efforts during the past few years have been to stimulate the interest of the medical profession and associated groups toward solving the problems associated with maternal care and forming state and local committees representing the medical profession to initiate and develop programs for securing adequate maternal care for all prospective mothers in their states and localities.

Such committees now exist in nearly all the states and territories and are, for the most part, official committees of the state and county medical societies. In some states temporary committees have been appointed by The American Committee on Maternal Welfare to function pending formal action by the state or territorial medical society. All of these committees have a sort of liaison with the parent American Committee, which has, and seeks to have, no control over the state and local committees but desires only to cooperate with them. The American Committee on Maternal Welfare desires to and wishes the subcommittees to work in harmony with all the governmental and other agencies which are interested in improving maternal care.

It realizes fully that there are many social and economic problems closely tied up with the dominant medical problems of maternal care; but it believes that proper medical and nursing care in the home, the out-patient clinic, the doctor's office, and the hospital are the most vital parts of maternal care.

It is further our opinion that the prevention of disability and deaths of mothers, fetuses, and newborn infants constitutes a unified problem and requires a single program for its solution.

We are also of the belief that maternal care cannot be divided into phases of antepartum, intrapartum, and postpartum care but insist that all these activities must be parts of a unified program.

Maternal care must be carried out intelligently, completely, and constantly for every prospective mother, no matter what her geographic, social, economic, or other status may be. The future of the human race depends upon such care being given to mothers and their infants.

Basic principles should be applied in a broad way, but the methods of application may differ. Various communities have differing needs depending upon many factors and facilities. It is our opinion that localities should work out their own



programs by the methods which are best suited to solving their varied problems. Each must take an inventory of its requirements and of the means available for meeting these requirements, and must supplement the existing resources with whatever other service and equipment is necessary to bridge the gaps in the program of complete maternal care.

We feel that the American Committee has made a definite contribution to developing programs of maternal care under the leadership of the medical profession. The formation of committees to lead and guide the programs of maternal care in every state and community should be the ultimate goal. This program is now well under way and to complete and carry out these plans requires only constant attention by those who are interested.

There should be closest cooperation between governmental, professional, and lay groups so that the best results may be obtained with the least friction and the minimum of antagonism, unnecessary duplication, and detrimental activities. This part of our program is well on its way and should continue further as its value is demonstrated.

In the past certain publications, such as the pamphlets on antepartum and delivery care, have emanated from our Committee. Also reprints of reports and articles have been circulated from time to time, usually without cost to the recipient.

There has just now appeared from The University of Chicago Press a booklet, bound either in cloth or in paper, entitled *Maternal Care*. This presents in concise and readable form the essential principles of antepartum, intrapartum, and postpartum care for the practitioner of obstetrics. It is of a size to be carried conveniently in one's coat pocket. The material was prepared largely by Drs. W. C. Danforth, G. W. Kosmak, R. L. DeNormandie, and myself. It was read by a number of the directors, and all the material and suggestions were carefully reviewed and edited. This booklet is being sold practically at cost and may be purchased from The University of Chicago Press at a price which varies with the type of binding and the number of copies purchased at any one time.

At the last annual meeting, acceptance was authorized of a proposal by Mead Johnson and Company to finance a "feature movie" for the education of the laity regarding the essentials of maternal care. The directors entered into such an arrangement; and a special committee consisting of Drs. E. D. Plass, J. R. McCord, A. J. Skeel, Philip F. Williams, and myself was appointed to carry the project through. We believe it marks a definite innovation and real progress in lay education regarding some of the fundamentals of life and will be released under certain conditions for lay education in states where the officials of the state medical societies approve of its presentation. It will be necessary to show it under proper conditions of visual and sound projection.

The American Committee on Maternal Welfare is now confronted with a large project of great importance which has been developed within the last eighteen months. I refer to the proposed "American Congress of Obstetrics and Gynecology." This idea was really started officially at the 1935 meeting of the Central Association of Obstetricians and Gynecologists by the appointment of a special committee consisting of Drs. E. D. Plass, Chairman, J. C. Litzenberg, and myself. The various national obstetric and gynecologic societies have been informed relative to this project, and formal action has been taken by some of them, including The Section on Obstetrics, Gynecology and Abdominal Surgery of the American Medical Association, The American Gynecological Society, and The American Association of Obstetricians, Gynecologists and Abdominal Surgeons. Among the sectional organizations, The New England Obstetrical and Gynecological Society, The Texas Association of Obstetricians and Gynecologists, and The Pacific Coast Society of Obstetrics and

Gynecology have likewise expressed their interest and willingness to cooperate. The American Board of Obstetrics and Gynecology expressed its opinion that while it approved the plan as tentatively outlined, the sponsorship of such a movement was completely outside its established functions.

The American Committee on Maternal Welfare at its meeting in Kansas City, May 13, 1936, in view of the fact that its membership is representative of the various national and sectional specialty societies, agreed to promote and organize such a congress, provided the involved organizations desired it to act in this fashion.

The other sources of financial support will be from membership dues and from the sale of space for commercial exhibits.

According to the present outlook the Congress will have to be largely self-supporting, as there appear to be no other sources of revenue available at the present time.

The time of the meeting has been tentatively set for September, 1939, and the place in the midwest, though the city has not been definitely selected. The major purpose of the Congress will be to educate professional and lay groups, and its scope, the problems of human reproduction, chiefly as they affect the woman, and diseases of the female reproductive organs. The major objective will be the better understanding, the integration, and the co-ordination of the knowledge and activities of the various professional, institutional, governmental, and volunteer agencies which are interested in promoting the welfare of motherhood and of womanhood.

The development of the Congress will constitute the major activity of our Committee during the ensuing two years or more. The American Committee will, however, continue its activities in other lines as well as is possible with its limited finances, etc. If we accomplish a better understanding of our purposes, a better integration of our ideas, and better harmony and closer coordination of effort on the part of those individuals and agencies interested in improving conditions surrounding motherhood and womanhood, our efforts will not have been in vain.

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## THE PROGRAM OF THE AMERICAN COLLEGE OF SURGEONS FOR MATERNAL CARE IN GENERAL HOSPITALS

MALCOLM T. MACEachern, M.D., CHICAGO, ILL.

*Associate Director of the American College of Surgeons*

THE American College of Surgeons is deeply interested in improving the care of the obstetric patient, particularly in the general hospital. The College through its Hospital Standardization program aims directly at the proper organization, management, and functioning of the obstetric department so as to afford the patient the greatest measure of safety and efficient service not only during complications of pregnancy, but during labor and the puerperium. It is believed that if hospitals will conscientiously live up to the requirements as laid down by the American College of Surgeons, maternal morbidities and mortalities can be reduced and kept close to a minimum. It is toward this objective that the efforts of the College are being directed at the present time.

In 1928 the College informally set up certain fundamental principles or criteria which it was believed would tend to improve the care of maternity patients in hospitals. There were ten well-thought-out clauses in the Minimum Standard for Obstetric Departments in Hospitals, as promulgated by the American College of

Surgeons, and the fulfillment of these is now required in all Approved Hospitals. These requirements have proved themselves to be sound and practical in their application. With minor adjustments, it is possible to apply them to any hospital caring for obstetric patients.

The following is a statement of each clause or requirement of the Minimum Standard for Obstetric Departments in Hospitals, with explanations when indicated and the present status of these requirements in a series of 1937 hospitals (1349 approved—588 not approved) as recently analyzed.

1. *Accommodation.*—*There shall be in all approved hospitals caring for obstetric patients a properly organized and equipped department of obstetrics, providing exclusive and adequate accommodation for mothers and the newborn.*

The foregoing requirement presupposes a definitely organized unit or service under competent administrative and professional supervision and direction. There must be a supervisor with special qualifications as an administrator and with a thorough knowledge of obstetric nursing technique and procedures. She must have special training, usually provided through acceptable postgraduate study and experience. Likewise, the professional supervision through a well-organized obstetric staff is most imperative. This can be best fulfilled through a well-organized clinical department or service within the medical staff with a chief or head of the department and associate assistant chiefs or heads as indicated by the size of the hospital and the amount of work. The chief or heads of the department should be held responsible for the professional policies and quality of the clinical or scientific work. Good organization of the medical staff, providing for control of the clinical work, is absolutely essential for the best results.

An analysis of 1937 hospitals under survey by the American College of Surgeons reveals the following results:

TABLE I. ORGANIZED DEPARTMENTS OF OBSTETRICS

All Hospitals Considered		1937
Acceptable	1702 (88%)	
Not acceptable	235 (12%)	
Approved Hospitals Considered		1349
Acceptable	1207 (89.5%)	
Not acceptable	142 (10.5%)	
Nonapproved Hospitals Considered		588
Acceptable	424 (72%)	
Not acceptable	164 (28%)	

Table I indicates satisfactory progress in developing proper departments of obstetrics in hospitals. There has been steady and most encouraging improvement in hospitals in this respect. Difficulty has been encountered in many of the smaller hospitals in providing satisfactory segregation of obstetric patients from other types in the hospital. It is most essential that such segregation be carried out as

TABLE II. SEGREGATION OF OBSTETRIC PATIENTS FROM OTHERS IN THE HOSPITAL

All Hospitals Considered		1937
Acceptable	1595 (82%)	
Not acceptable	342 (18%)	
Approved Hospitals Considered		1349
Acceptable	1207 (89.5%)	
Not acceptable	142 (10.5%)	
Nonapproved Hospitals Considered		588
Acceptable	388 (66%)	
Not acceptable	200 (34%)	

a safeguard against infection. Likewise, there must be complete segregation of nursing personnel. Table III indicates how far this is being accomplished in the series of hospitals considered.

TABLE III. SEGREGATION OF NURSING PERSONNEL

All Hospitals Considered		1937
Acceptable	1308 (68%)	
Not acceptable	629 (32%)	
Approved Hospitals Considered		1349
Acceptable	1107 (82%)	
Not acceptable	242 (18%)	
Nonapproved Hospitals Considered		588
Acceptable	201 (34%)	
Not acceptable	387 (66%)	

2. *Segregation or Isolation of Infected Mothers.*—*Special accommodations and facilities shall be available for all cases of infections, elevated temperatures, or any other conditions inimical to the safety and welfare of the patients in the obstetric division.*

The patient with a temperature, sore throat, puslike discharge, or infection of any nature, is a menace to other patients in the obstetric division and should be segregated immediately in order not to infect other patients. To this end, so far as practical and possible, all hospitals caring for obstetric patients are urged to set aside a special, properly arranged, self-contained unit, apart from the obstetric division. Any cases which show infection of any kind should not be placed on surgical or gynecologic wards where there are open wounds which might be readily infected. Adequate segregation or isolation must be promptly carried out so as to avoid the spreading of infection from one patient to another. In respect to this aspect, the analysis of the same group of hospitals already referred to reveals the results as shown in Table IV.

TABLE IV. SEGREGATION OR ISOLATION OF INFECTED MOTHERS

All Hospitals Considered		1937
Acceptable	1852 (95.6%)	
Not acceptable	85 ( 4.4%)	
Approved Hospitals Considered		1349
Acceptable	1319 (97.7%)	
Not acceptable	30 ( 2.3%)	
Nonapproved Hospitals Considered		588
Acceptable	533 (90.6%)	
Not acceptable	55 ( 9.4%)	

TABLE V. FACILITIES FOR THE ISOLATION OR SEGREGATION OF THE NEWBORN WITH INFECTION

All Hospitals Considered		1937
Acceptable	1785 (92.2%)	
Not acceptable	152 ( 7.8%)	
Approved Hospitals Considered		1349
Acceptable	1252 (92.80%)	
Not acceptable	97 ( 7.20%)	
Nonapproved Hospitals Considered		588
Acceptable	533 (90.64%)	
Not acceptable	55 ( 9.36%)	

It is quite apparent that though admirable progress has been made by hospitals in providing facilities for infected or suspicious cases much yet remains to be accomplished. It is frequently difficult for the small hospital to provide proper segregation of infected or potentially infected cases because of limited accommodations. Frequently this can be done only by using private rooms elsewhere than in the obstetric division.

It is also essential that provision be made for the segregation or isolation of the newborn when they develop skin rashes, bronchial conditions, or infection of any kind. In this respect, the survey reveals the results as shown in Table V.

3. *Facilities.*—*Adequate clinical laboratory, x-ray, and other facilities, under competent supervision, shall be provided for the diagnosis and treatment of obstetric patients.* Inasmuch as the obstetric service in the hospital depends on the general facilities of the institution, usually the necessary clinical laboratory, x-ray, and other services are readily available and offer a complete service to the obstetric patient. These services in general may be regarded as satisfactory and well provided.

4. *Administration.*—*The administration of the obstetric department shall be under the direction of a competent, registered nurse who has executive ability, who is especially trained in obstetric nursing, and who shall have an adequate number of assistants and other personnel to carry on efficiently the work of the department.* Emphasis has been placed on the need of having a competent graduate nurse in charge of the obstetric department. This presupposes a person with administrative ability and special training in the management of obstetric patients. She must be a good manager and a competent department head. The analysis of the series of hospitals used as a basis for this report is as shown in Table VI. In this analysis there was found a large and varying range of administrative ability.

TABLE VI. COMPETENT ADMINISTRATION OF OBSTETRIC DEPARTMENT

All Hospitals Considered		1937
Acceptable	1860 (96%)	
Not acceptable	77 (4%)	
Approved Hospitals Considered		1349
Acceptable	1333 (99%)	
Not acceptable	16 (1%)	
Nonapproved Hospitals Considered		588
Acceptable	527 (90%)	
Not acceptable	61 (10%)	

5. *Supervision.*—*The obstetric division of the medical staff shall be so organized as to exercise adequate control over the clinical work in that department, such organization to include a chief or head of the department or service who shall be responsible for the general supervision of the obstetric work of the hospital.* It is most important that all the obstetric work of the hospital be under competent supervision at all times. This presupposes good medical staff organization. It is recognized that in most hospitals obstetrics is practiced largely by general practitioners and the work is not limited to qualified obstetricians. In the survey, it was found that the obstetric staff was organized, although frequently too loosely and without sufficient positive supervision over the actual work. Active supervision by the chief or head of the department or service must extend to all types of patients rather than to the ward patients only. Sometimes this supervision is delegated to a committee. Finally, one may say that while better control and supervision of the obstetric work in hospitals is evident, there is much need for greater achievement in this respect. Better medical staff organization is widely indicated.

6. *Records.*—*Accurate and complete medical records complying with the required standard shall be provided for all patients admitted to the obstetric department.* Adequate obstetric records present a real difficulty in many hospitals. Too often



these are lacking in sufficient data, particularly in respect to the pregnancy or pre-natal record, pelvic measurements, and indications for operative interference. The forms for record taking in connection with obstetric patients are generally very good. The survey of hospitals in respect to obstetric records reveals the status of this phase

TABLE VII. ADEQUATE OBSTETRIC RECORDS

All Hospitals Considered		1937
Acceptable	1035 (53%)	
Not acceptable	902 (47%)	
Approved Hospitals Considered		1349
Acceptable	908 (67.42%)	
Not acceptable	441 (32.58%)	
Nonapproved Hospitals		588
Acceptable	127 (21.59%)	
Not acceptable	461 (78.41%)	

of the work as shown in Table VII. An analysis of the obstetric records of the same group of hospitals for recorded indications of operations reveals the conditions as shown in Table VIII. It is quite evident that adequate obstetric records are still

TABLE VIII. RECORDED INDICATIONS FOR OPERATIVE OBSTETRICS

All Hospitals Considered		1937
Acceptable	787 (46%)	
Not acceptable	1150 (54%)	
Approved Hospitals Considered		1349
Acceptable	672 (42.40%)	
Not acceptable	677 (57.60%)	
Nonapproved Hospitals Considered		588
Acceptable	115 (19.55%)	
Not acceptable	473 (80.45%)	

lacking in many hospitals, and special efforts should be directed in this respect. More interest and cooperation are required on the part of the medical staffs of hospitals; and the management, too, must realize its responsibility. Continuous efforts are required in order that obstetrical records may reach acceptable standards.

7. *Consultations.*—Major obstetric procedures shall be carried out only after consultations and indications for interference are recorded on the patient's clinical record, exceptions being made when the attending physician is a qualified obstetrician and in case of emergency when time does not permit.

It is apparent that consultations are increasing. Frequently, however, the consultant is not a qualified obstetrician and this may make the consultation of little value. Such consultations should be with qualified obstetricians. The results of the survey in respect to this aspect of obstetric work are as shown in Table IX. Better enforcement of the rule or policy of recorded consultations of an acceptable type is desired.

TABLE IX. CONSULTATIONS

All Hospitals Considered		1937
Acceptable	675 (34.85%)	
Not acceptable	1262 (65.15%)	
Approved Hospitals Considered		1349
Acceptable	584 (43.29%)	
Not acceptable	765 (56.71%)	
Nonapproved Hospitals Considered		588
Acceptable	91 (15.47%)	
Not acceptable	497 (84.53%)	

It is quite apparent that though admirable progress has been made by hospitals in providing facilities for infected or suspicious cases much yet remains to be accomplished. It is frequently difficult for the small hospital to provide proper segregation of infected or potentially infected cases because of limited accommodations. Frequently this can be done only by using private rooms elsewhere than in the obstetric division.

It is also essential that provision be made for the segregation or isolation of the newborn when they develop skin rashes, bronchial conditions, or infection of any kind. In this respect, the survey reveals the results as shown in Table V.

3. *Facilities.*—*Adequate clinical laboratory, x-ray, and other facilities, under competent supervision, shall be provided for the diagnosis and treatment of obstetric patients.* Inasmuch as the obstetric service in the hospital depends on the general facilities of the institution, usually the necessary clinical laboratory, x-ray, and other services are readily available and offer a complete service to the obstetric patient. These services in general may be regarded as satisfactory and well provided.

4. *Administration.*—*The administration of the obstetric department shall be under the direction of a competent, registered nurse who has executive ability, who is especially trained in obstetric nursing, and who shall have an adequate number of assistants and other personnel to carry on efficiently the work of the department.* Emphasis has been placed on the need of having a competent graduate nurse in charge of the obstetric department. This presupposes a person with administrative ability and special training in the management of obstetric patients. She must be a good manager and a competent department head. The analysis of the series of hospitals used as a basis for this report is as shown in Table VI. In this analysis there was found a large and varying range of administrative ability.

TABLE VI. COMPETENT ADMINISTRATION OF OBSTETRIC DEPARTMENT

All Hospitals Considered		1937
Acceptable	1860 (96%)	
Not acceptable	77 (4%)	
Approved Hospitals Considered		1349
Acceptable	1333 (99%)	
Not acceptable	16 (1%)	
Nonapproved Hospitals Considered		588
Acceptable	527 (90%)	
Not acceptable	61 (10%)	

5. *Supervision.*—*The obstetric division of the medical staff shall be so organized as to exercise adequate control over the clinical work in that department, such organization to include a chief or head of the department or service who shall be responsible for the general supervision of the obstetric work of the hospital.* It is most important that all the obstetric work of the hospital be under competent supervision at all times. This presupposes good medical staff organization. It is recognized that in most hospitals obstetrics is practiced largely by general practitioners and the work is not limited to qualified obstetricians. In the survey, it was found that the obstetric staff was organized, although frequently too loosely and without sufficient positive supervision over the actual work. Active supervision by the chief or head of the department or service must extend to all types of patients rather than to the ward patients only. Sometimes this supervision is delegated to a committee. Finally, one may say that while better control and supervision of the obstetric work in hospitals is evident, there is much need for greater achievement in this respect. Better medical staff organization is widely indicated.

6. *Records.*—*Accurate and complete medical records complying with the required standard shall be provided for all patients admitted to the obstetric department.* Adequate obstetric records present a real difficulty in many hospitals. Too often

these are lacking in sufficient data, particularly in respect to the pregnancy or prenatal record, pelvic measurements, and indications for operative interference. The forms for record taking in connection with obstetric patients are generally very good. The survey of hospitals in respect to obstetric records reveals the status of this phase

TABLE VII. ADEQUATE OBSTETRIC RECORDS

All Hospitals Considered		1937
Acceptable	1035 (53%)	
Not acceptable	902 (47%)	
Approved Hospitals Considered		1349
Acceptable	908 (67.42%)	
Not acceptable	441 (32.58%)	
Nonapproved Hospitals		588
Acceptable	127 (21.59%)	
Not acceptable	461 (78.41%)	

of the work as shown in Table VII. An analysis of the obstetric records of the same group of hospitals for recorded indications of operations reveals the conditions as shown in Table VIII. It is quite evident that adequate obstetric records are still

TABLE VIII. RECORDED INDICATIONS FOR OPERATIVE OBSTETRICS

All Hospitals Considered		1937
Acceptable	787 (46%)	
Not acceptable	1150 (54%)	
Approved Hospitals Considered		1349
Acceptable	672 (42.40%)	
Not acceptable	677 (57.60%)	
Nonapproved Hospitals Considered		588
Acceptable	115 (19.55%)	
Not acceptable	473 (80.45%)	

lacking in many hospitals, and special efforts should be directed in this respect. More interest and cooperation are required on the part of the medical staffs of hospitals; and the management, too, must realize its responsibility. Continuous efforts are required in order that obstetrical records may reach acceptable standards.

7. *Consultations.*—Major obstetric procedures shall be carried out only after consultations and indications for interference are recorded on the patient's clinical record, exceptions being made when the attending physician is a qualified obstetrician and in case of emergency when time does not permit.

It is apparent that consultations are increasing. Frequently, however, the consultant is not a qualified obstetrician and this may make the consultation of little value. Such consultations should be with qualified obstetricians. The results of the survey in respect to this aspect of obstetric work are as shown in Table IX. Better enforcement of the rule or policy of recorded consultations of an acceptable type is desired.

TABLE IX. CONSULTATIONS

All Hospitals Considered		1937
Acceptable	675 (34.85%)	
Not acceptable	1262 (65.15%)	
Approved Hospitals Considered		1349
Acceptable	584 (43.29%)	
Not acceptable	765 (56.71%)	
Nonapproved Hospitals Considered		588
Acceptable	91 (15.47%)	
Not acceptable	497 (84.53%)	

8. *Morbidity.*—All hospitals caring for obstetric patients shall adopt a morbidity standard by which they can better control morbidities. It was found in the survey that only a limited number of hospitals had actually adopted and were using a morbidity standard. It is evident that insufficient attention has been given to this matter. All hospitals should be urged to adopt one of the recognized morbidity standards, particularly the one formulated and recommended by the American Committee on Maternal Welfare. It is difficult to measure the efficiency of the medical and nursing services and stimulate regulation and investigation of unfavorable conditions without the use of such a standard. Further, the information gained thereby provides subject matter for discussion in the review and analysis of the work of the obstetric department each month.

9. *Conferences.*—A thorough review and analysis of the obstetric work in the hospital shall be made at least monthly, with particular attention given to mortalities and morbidities or any of the results not up to the required standard.

Systematic and thorough review and analysis of the work in the obstetric department of the hospital is lacking in a number of hospitals. While the survey shows a review and analysis is attempted in the majority of hospitals surveyed, yet the analysis is not as thorough and complete as it should be nor is there adequate consideration of morbidities. Possibly in the general staff conference, the work of the obstetric division may be overlooked to a certain extent. It is for this reason that the departmental conference for the review and analysis of the obstetric work should be encouraged.

TABLE X. ANALYSIS OF OBSTETRIC WORK

All Hospitals Considered		1937
Acceptable	704 (36.3%)	
Not acceptable	1233 (63.7%)	
Approved Hospitals Considered		1349
Acceptable	625 (46.3%)	
Not acceptable	724 (53.7%)	
Nonapproved Hospitals Considered		588
Acceptable	79 (13.4%)	
Not acceptable	509 (86.6%)	

Table X gives the results of the survey in respect to the obstetric work in the hospitals under survey. From the above statistics it is apparent that there still exists need for improving the review and analysis of the obstetric work in hospitals with particular emphasis on morbidities and mortalities, and so far as possible and practicable such a review and analysis can best be carried on through the departmental conference.

10. *Training.*—Opportunity shall be afforded student nurses in hospitals having a school of nursing for adequate theoretical instruction and practical experience in prenatal work, observation of the patient in labor, delivery room technique and postpartum care of the mother, as well as the proper nursing care of the newborn.

Usually the training of student nurses in obstetric work was found to be fairly well done, although frequently the period of time allowed for experience in this division was too limited. It would appear to be most difficult to offer student nurses adequate essential training and experience in this work under a period of four months at least. In many instances this is not more than three months, and in some instances it is less. It would also appear to be advisable that the student nurse complete her work in the surgical department before being assigned to the obstetric division. The teaching and training of the student nurse, as well as that of the interne, could be greatly enhanced by more individual instruction at the bedside and group demonstrations on patients. Careful instruction and supervised

experience in observing the patient in labor, and accuracy of recording observations, are most desirable. Nurses' records as a whole were fairly good, but in many instances could be improved in the details mentioned.

It was noted in the survey that many institutions found it most difficult to obtain postgraduate training for their nurses to fit them for executive positions. There appears to be a general lack of good postgraduate training opportunities for those desirous of further advancement and wishing to prepare themselves for administrative position. Very few hospitals offer well-organized, desirable courses in this regard. More postgraduate courses of a desirable standard are greatly needed.

During the survey certain other observations were made and certain conclusions arrived at. These were as follows:

*Pelvic Measurements.*—The practice of carefully measuring obstetric patients prior to the eighth month, or even at any time, appears to be sadly neglected. Regardless of the merits or demerits of pelvimetry, it should not be neglected and, when properly done, may result in lessening the ever-increasing amount of operative obstetrics as noted in recent years. The members of the medical profession who practice obstetrics are in great measure negligent about this important phase of diagnosis as to the relation between the size of the child and the pelvic outlet. A more effective enforcement of the rule that all obstetric patients should be measured, would do much to improve obstetric results, particularly in cases of contracted pelvis.

*Incidence of Cesarean Section.*—An incomplete analysis of the hospitals under survey indicated the following results:

All Hospitals Considered	168,052 deliveries
Total Number Cesarean Sections	5,445
Percentage	3.2
Approved Hospitals Considered	159,887 deliveries
Total Number Cesarean Sections	5,027
Percentage	3
Nonapproved Hospitals Considered	8,165 deliveries
Total Number Cesarean Sections	418
Percentage	5

The lack of recorded indications before cesarean section was noted in a large percentage of cases. Not infrequently consultations were lacking. In this tabulation, it was interesting to note the wide variation in the incidence of cesarean sections in individual hospitals, this varying from zero to 19 per cent. Better control of this phase of obstetric work is indicated.

*Medical Care of the Newborn.*—A study was made as to who took care of the baby after birth and the following was noted:

Obstetrician	1665
Pediatrician	207
Obstetrician and Pediatrician	32
Ward Service	34

It is quite evident there is no uniform method of caring for the infant or newborn, but this varies considerably. There does appear to be a distinct tendency in the larger and better organized obstetric clinics or departments to put the newborn on the pediatric service, but this is not yet universal by any means.



*Education of Mothers Before Leaving Hospital.*—Unfortunately too many mothers leave the hospital without adequate instruction as to their own care or that of their babies. Too often the splendid results obtained in the hospital are for naught because of the ignorance of the new mother as to her own hygiene and diet and the proper care of the baby as to feeding, bathing, clothing, fresh air, etc. The supervisor of the obstetric department can do a great deal to remedy this condition by seeing that each mother, prior to discharge, is carefully instructed so that after her return home a proper regimen can be carried out which will assure a healthy mother and child. Every hospital should be equipped to carry on this valuable service.

#### CONCLUSION

The comments and tables submitted are not to be considered hypercritical of the care of obstetric patients in general hospitals, but rather as a basis for constructive thought and action in encouraging and stimulating every hospital to put into effect such conditions as will insure full compliance with the requirements as laid down by the American College of Surgeons. Indeed, if a graph of progress could be indicated during the period Hospital Standardization has been carried on, vast improvement could be noted in every phase of the work described in the text of this presentation. Conditions surrounding the care of the obstetric patient have improved immensely as well as other phases of hospital work during the same period.

The problem now is one of education, not only of hospital executives and governing boards of hospitals, but also of members of medical staffs who must share some of the responsibility for the proper care of the patient. Governing boards, hospital executives, and medical staffs must unitedly and with the closest cooperation put forth every possible effort to meet the requirements as stated and see that they are carried out to the fullest extent. When this is done, greater improvements may be expected in the obstetric service in every hospital; and then morbidities and mortalities will be further reduced.

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### OBSERVATIONS ON THE TEACHING OF OBSTETRICS

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IN DISCUSSING the teaching of any particular subject in the undergraduate medical curriculum, it is important to bear in mind the recognized objectives and some of the general trends involving the curriculum as a whole. The principal objectives of undergraduate medical education have been stated by Dr. Fred L. Adair as follows: "The laying of the foundations for a knowledge of medicine on which subsequent structures can be built for general or special practice and for teaching or research and for public health activities." In many colleges there is evident a distinct effort to make the entire curriculum a coordinated whole directed toward the laying of such a sound foundation for a career in the field of medicine.

For a number of years there has been a tendency to emphasize clinical training in the undergraduate course. The fundamental sciences are being taught with more emphasis on their clinical implications. Correlation clinics in connection with the teaching of these subjects are becoming recognized features of the curriculum. In most of our more progressive medical schools the students are introduced to the clinical subjects in the second year, and the third and fourth years are devoted almost entirely to clinical work in the hospital and the outpatient department.

There is no longer an effort to cover fully all subjects in didactic exercises. Emphasis is rather placed on a thorough understanding of the principles of the fundamental sciences in their relations to clinical medicine, the development of various technics in the examination of patients, the acquiring of proper methods of work, the development of the scientific viewpoint, and the following of the progress of disease together with a study of the effects of certain therapeutic procedures. Increasing emphasis is being placed upon the preventive and the social and community aspects of medicine.

The fundamental nature and the incompleteness of the undergraduate course as far as preparation for the practice of medicine is concerned are fully recognized by both medical faculties and graduates. Although required by but few medical colleges and only a few state licensing boards, more than 99 per cent of all graduates of the medical colleges of this country are serving internships after graduation and before beginning practice. Thus, practically all graduates acquire considerable clinical experience beyond the formal medical course. This situation emphasizes the importance of the internship as an integral part of medical education.

The objectives to be attained in connection with the undergraduate teaching of obstetrics will depend upon the subsequent experience a student is to have before beginning practice and the responsibilities which will be his as a practitioner. Certainly every graduate before beginning the general practice of medicine should have adequate knowledge and training in preconceptional, prenatal, delivery, and post-partum care to justify him in assuming the responsibilities involved in ordinary safe obstetric care. This should be one of the ultimate objectives and responsibilities of those responsible for medical education.

Although as previously stated more than 99 per cent of our graduates serve internships before beginning practice, only 78 per cent serve general or rotating internships, the remainder serving in specialized or so-called "mixed" internships. Many of this latter group have no obstetric training whatever in connection with their internships.

Recent studies indicate that practically one-tenth of the graduates entering upon the general practice of medicine have served such straight or mixed internships and have had no other graduate training before entering practice.

Let us add to this picture the fact that more than 25 per cent of all the graduates of the medical colleges in this country are today locating in communities of less than 5,000 population and an additional 6 per cent are locating in communities of from 5,000 to 10,000 population.

Regardless of the feeling which any group may have in regard to the practice of obstetrics being a specialty, these data give us some idea as to the usual internship training in obstetrics and the responsibilities graduates are called upon to assume as they enter upon the practice of medicine.

It is also on the basis of such data that the medical colleges must recognize their objectives and responsibilities in the teaching of obstetrics.

I will now discuss briefly the present status of obstetric teaching in the medical colleges of this country as observed in connection with my visits to the colleges as a part of the recently completed survey of medical education.

At the very beginning of the survey it was recognized that it would be impossible to analyze and evaluate accurately all of the details of the various elements of the undergraduate curriculum. However, certain fundamental facts could be definitely determined, and in general it was possible to formulate a fairly clear picture of the courses being offered.

During recent years there has been considerable discussion in regard to combining gynecology and obstetrics in a single department. Although 38 of the 67

colleges in the United States teaching obstetrics have such combined departments of gynecology and obstetrics, in many instances this combination is entirely artificial and apparently is merely a paper set-up in response to a popular trend.

The didactic teaching is begun in the second year in 29 of the colleges. Most of the colleges devote an adequate amount of time to the didactic teaching, and a number, what would appear to be an unwarrantedly large amount of time.

All of the colleges offer their students some experience in prenatal examinations and prenatal care. In too many instances this aspect of the teaching is entirely inadequate, unsystematic, and haphazard. The number of prenatal clinics attended by students varies from two to thirty or more. In some colleges students have their prenatal clinic experience after they have had their experience in deliveries.

The number of deliveries observed by students varies from 2 to 100. All too frequently these involve students in large groups observing deliveries in the hospital amphitheatre.

The number of actual deliveries by students varies from none up to 50 or more. In 16 of the schools the students have less than 5 deliveries each. In 34 colleges each student has at least one delivery in the teaching hospital. The complete availability of an adequate amount of clinical material under conditions which permit a high standard of training and experience for undergraduates and internes is apparently becoming a very serious problem in connection with the teaching of obstetrics.

Forty-five colleges have home delivery services available for student training. Sixteen of these provide no regular supervision of student deliveries. In 10 colleges students are supervised by an interne and in 13 by a resident. Only 6 colleges offer regular supervision of student deliveries in the home by a member of the departmental staff above the rank of resident.

Most of the colleges are largely dependent upon home deliveries for the actual experience of the students in delivery technic. There is occurring a marked decrease in the number of deliveries in the home. Statistics indicate an increase of approximately 70,000 births in the hospitals of the United States during 1936 as compared with 1935. In many localities practicing physicians are being paid from government funds for the delivery of the indigent in their homes. Several of the colleges reported that their teaching home delivery services had been practically wiped out by the initiation of such programs.

Fifteen colleges have no required supervised hospital clerkships in obstetrics, involving the assignment of cases to be followed through labor.

Although questionnaire data indicated otherwise, only 22 colleges reported systematic manikin practice by the students. I found a great divergence of opinion on the part of the professors of obstetrics as to the value of manikin practice. Some feel that it is an essential and very valuable feature of the undergraduate course while a few feel that it is practically worthless.

I will now endeavor to outline briefly my personal reactions to the teaching of obstetrics in this country.

Obstetrics is but one element in what should be a well-coordinated curriculum. Much of the knowledge and training essential to obstetrics is taught in the departments of anatomy, physiology, bacteriology, pathology, medicine, and surgery. Training in proper methods of work and the development of the scientific viewpoint must be a part and parcel of every course given in the school.

My own feeling is that the number of didactic hours devoted to obstetrics matters little so long as there is adequate time to cover the essentials systematically. My chief interest is in the competence, interest, and viewpoint of the teacher to whom these hours are assigned. All too frequently the book is "cut" and parceled out

to a large group of young instructors, each to cover his section as best he may. Frequently there seems to be a tendency for these young teachers to emphasize the teaching of operative obstetrics, as they find it more interesting in connection with their own individual development as obstetricians.

One of the main objectives of the didactic hours should be to point out and clarify the essentials without which a student cannot hope to have a clear understanding of the subject. They must also serve as a stimulus for further independent study by the student. And may I emphasize at this point the importance of "tuning" the curriculum in any particular college to its average student. There is little to worry about in connection with the outstanding student.

Obstetric examinations, including abdominal palpation and external and internal pelvimetry, are frequently taught in a haphazard manner while the teaching of the rest of physical diagnosis is highly systematized. There are more definite and usually more satisfactory opportunities for teaching obstetric examinations than there are for teaching many of the other aspects of physical diagnosis. Furthermore, as a graduate enters practice there frequently will be much more at stake in connection with the making of an obstetric examination.

With the disagreement among obstetricians in regard to the value of manikin practice, I will not disclose my reaction to it further than to state that I believe that one of its functions should be to impress upon the student the difficulties of operative obstetrics rather than to teach operative obstetrics.

During the course of the survey I developed some very strong reactions to the delivery experience offered medical students. Granting the serious shortage of available clinical cases merely emphasizes the importance of using to the best possible advantage the cases which are available for teaching both in the hospital and in the home. This suggests that each student delivery should be supervised by a competent teacher. One such delivery surely means more to the average student than a dozen unsupervised deliveries.

To me it appears that, granting the required minimum of course content, it is much more important how well the subject is taught than how much it is taught.

Few schools can hope to give their average undergraduate training and experience in the handling of the various complications of labor but all can teach him the importance of their early recognition so that the services of a specialist can be secured.

Every college should impress upon its students that no graduate has the right to enter general practice until he is competent to manage a normal obstetric case and competent to recognize the abnormal in connection with which he will need experienced assistance.

Personally I have little confidence in detailed requirements for a certain amount of graduate experience in obstetrics set up by state boards of licensure, serving in any material way to improve the practice of obstetrics.

The development of a proper viewpoint on the part of medical college graduates and the creation of a public demand for safe maternity care will accomplish much more than any legal requirements.

As far as the medical curriculum is concerned the four essentials to a satisfactory undergraduate course in obstetrics are ample facilities, a reasonable allotment of time, capable teachers, and the maintenance of high standards by the institution as a whole.

# Department of Reviews and Abstracts

CONDUCTED BY HUGO EHRENFEST, M.D.

## Selected Abstracts

### Complications of Pregnancy With Disease

**Brindeau, Kowilsky, R., and Kowilsky, S.: Pulmonary Tuberculosis in the Pregnant Woman, Presse méd. 93: 1865, 1935.**

The obstetrician should be guided by the findings and conclusions of the tuberculosis specialist upon whom rests the major burden of the responsibility for the care of the tuberculous pregnant woman.

In evaluating the physical status of the patient they greatly stress a biologic reaction or tendency which they define as the "intensity of the caseifying process." According to the latter there are four types: (1) Acute, (2) subacute, (3) chronic fibroulcerative, and (4) discrete fibroulcerative.

1. The acute forms with rapid evolution, high fevers and marked caseous tendency are hopeless from the standpoint of medical or obstetric therapeutics (collapse therapy or abortion).

2. For the other forms, artificial pneumothorax, uni- or bilateral, or therapeutic abortion, or a judicious combination of both procedures may be indicated.

3. Pregnancy exerts, during the first three months and especially in the post-partum period, a definite, aggravating influence upon the evolution of the tuberculous process. This effect of exacerbation is noted also in extrapulmonary tuberculous lesions, and even in nontuberculous infections.

ARNOLD GOLDBERGER.

**Frisch, A. V.: Pulmonary Tuberculosis and Pregnancy, Wien. klin. Wchnschr. 42: 1287, 1936.**

That pulmonary tuberculosis may occasionally be unfavorably influenced by pregnancy is well known. Whether it always justifies interruption of pregnancy is questionable. In the milder, more benign cases of pulmonary tuberculosis, termination of pregnancy is not necessary. In the more severe types such as the dense fibrous diffuse tuberculosis, interruption of pregnancy may be recommended especially where there is hemoptysis, fever and tubercle bacilli in the sputum. In a follow-up of 100 cases of pregnancy complicated with tuberculosis, not one case of tuberculosis was unfavorably influenced by the pregnancy. In a severe case the patient went to term but died later of tuberculosis. The author recommends collapse therapy also during pregnancy.

W. B. SERBIN.

**Peters and Davenport: Pregnancy and Parturition During the Course of Bilateral Artificial Pneumothorax, Am. Rev. Tuberc. 35: 71, 1937.**

The writers present a comprehensive review of pneumothorax therapy done on pregnant women. The coincidence of bilateral artificial pneumothorax obviously is of



rather rare occurrence. Probably not more than the 16 cases (briefly quoted) so far have been reported. A new instance is described in detail. Among other conclusions the writers mention the necessity of revision of prevalent views concerning proper procedure when a pregnancy starts in the course of unilateral or bilateral pneumothorax. There is no justification for interruption either of pregnancy or treatment. Indeed, often pneumothorax therapy is clearly indicated when a phthisical patient becomes pregnant or when a pulmonary tuberculosis develops in a pregnant woman. Instead of thinking first of interruption we must think first of proper treatment of the tuberculosis. Of course, pneumothorax at times is entirely ineffective but so is abortion.

HUGO EHRENFEST.

**Praloran, Luigi: Collapse Therapy in Pregnancy, Clinica ostet. 15: 634, 1936.**

The author thoroughly reviews the history of collapse therapy, citing the first case of pulmonary tuberculosis during pregnancy cured by Forlanini (1910) with the pneumothorax treatment.

He reports 80 cases of pregnant women placed on collapse therapy, treated as follows: Unilateral pneumothorax, 50 women; bilateral pneumothorax, 2; phrenectomy and pneumothorax, 11; phrenectomy, 14; Jacobaens operation and pneumothorax, 1; anterolateral thoracoplasty, 1; and apical collapse with phrenectomy, 1.

Up to date the results are as follows: Improved, 63 to 78.7 per cent; not improved, 12 to 15 per cent; stationary, 3 to 3.8 per cent, and dead, 2 to 2.5 per cent.

The effect upon the duration of pregnancy was as follows: Delivered at term, 72 to 90 per cent; delivered prematurely, 6 to 7.5 per cent; aborted 2 to 2.5 per cent.

The author concludes that collapse therapy is undoubtedly efficacious during pregnancy.

AUGUST F. DARO.

**Lissack, E.: Pregnancies After Nephrectomy for Tuberculosis, J. Missouri M. A. 33: 450, 1935.**

In general, tuberculosis of the kidney precludes pregnancy. The author reports a patient who was delivered of four living and healthy children after nephrectomy for tuberculosis. He concludes that nephrectomy is not a contraindication to pregnancy and that patients showing no abnormalities may be allowed to continue pregnancy under close observation.

J. THORNWELL WITHERSPOON.

**Compan, V.: Influence of Pregnancy on Renal Excretion, Rev. med. de Barcelona 25: 351, 1936.**

Alterations in renal excretion in pregnancy are due to a variety of causes. Undoubtedly the endocrine changes which cause excretion of lutein and prolactin in the urine have something to do with these alterations, and may eventually be proved to have some effect in predisposing to infection. That mechanical changes are important is evident, as the increasing development of the uterus causes anatomic alterations in the pelvic ureter, and the enlarged uterus itself may cause sufficient pressure on the ureters at the pelvic brim to obstruct the passage of a catheter above this level.

In the treatment of pyelitis of pregnancy the author is an exponent of the indwelling ureteral catheter, which he often leaves in situ for twelve days or more, relying on this means to secure adequate drainage of the infected renal pelvis. If pelvic lavage

is used he counsels the employment of either sterile water or a 1 to 2 per cent solution of argyrol, and deprecates the use of the more irritating silver nitrate or higher concentrations of argyrol.

Vaccine-therapy has not yielded any demonstrable effects. Chemical therapy is generally exhibited as intravenous methenamine, or, better, as intravenous mercurochrome. The former is not employed when cystitis is present, and the latter only in doses of 30 mg. during the febrile phases of infection.

THOMAS R. GOETHALS.

**Soule, S. D.: Syphilis and Pregnancy, J. Missouri M. A. 34: 84, 1937.**

Every pregnant woman should have a blood Wassermann taken at the time of her first visit. Intensive antisyphilitic treatment should be instituted as soon as a diagnosis of syphilis has been made. When the diagnosis is doubtful, treatment should be advised as a prophylactic measure. The patient should understand her condition clearly. Her cooperation is absolutely essential to successful completion of an efficient and adequate course of therapy. Treatment consists of weekly arsphenamine or nearsphenamine injections in series of at least ten treatments. The last few intravenous injections are overlapped with intramuscular bismuth injections, which are then continued for six to ten weeks, followed by a return to arsphenamine. When time does not permit an adequate course of treatment, the drug of choice is arsphenamine, given at weekly intervals, for the remaining duration of pregnancy. Treatment is continuous without rest periods from the time of diagnosis until delivery. An intensive follow-up of the newborn should be instituted for at least three months and preferably for a year. A centralized unit, where prenatal observation is made at the same time that treatment is administered, has proved satisfactory. Attendance has been better and the amount of treatment administered per patient has been greater. Under this care patients who receive a moderate amount of treatment have almost a 95 per cent opportunity of delivering a living normal, nonsyphilitic child.

J. THORNWELL WITHERSPOON.

**Castallo, M. A., and Rakoff, E. E.: An Analysis of 259 Cases of Syphilis Complicating Pregnancy, Penn. M. J. 39: 24, 1935.**

Serologically negative pregnant women should always be given antisyphilitic therapy when there is a past history suggestive of syphilis such as repeated premature deliveries, macerated fetuses, stillbirths, when there has been a previous positive Wassermann reaction, when the paternal Wassermann reaction is positive, and when previous clinical signs of the disease have been elicited.

The authors emphasize that every syphilitic mother, irrespective of the amount of treatment she has received in the past and regardless of her physical condition or the status of her present Wassermann reaction, should receive early and adequate antisyphilitic therapy during each pregnancy to insure the birth of a live, nonsyphilitic baby. They agree that the pregnant syphilitic woman tolerates treatment much better than the nonpregnant, and that complications following treatment are only one fifth as frequent as after the treatment of a nonpregnant woman. The dose of the drug, however, should be less than that administered to the nonpregnant individual.

The authors found, as is usually the case in a large clinic, that invariably the percentage of syphilitic negroes is considerably higher (usually 3 to 5 times) than for white women. The negro, however, tolerates syphilis much better, both as to the outcome of the pregnancy and clinical relapse, than does the white woman.

In the authors' series of 259 cases, neoarsphenamine was administered to 120, acetylarsan to 57, 8 were treated by private physicians while 65 patients received no treatment at all. Twelve patients received combined therapy.

Among the 65 untreated syphilitic patients there were 20 per cent stillbirths and 10.8 per cent miscarriages, whereas in 80 patients receiving 6 or more treatments there were 2.5 per cent stillbirths and no miscarriages. In 37 patients in whom treatment was started before the sixth month there were no stillbirths and 5.4 per cent miscarriages. The results for the entire group of syphilitic pregnant women, treated and untreated, showed 8.3 per cent stillbirths and 3.5 per cent miscarriages.

The authors' statistics further showed that 13.1 per cent of the patients with a positive Wassermann reaction who received no treatment and had live births, lost their babies before discharge from the hospital. Among the group of patients who had treatment prior to the sixth month of pregnancy, only 2.9 per cent of the babies died before the mothers left the hospital.

In the 259 cases reviewed there was one maternal death from septicemia following cesarean section. There were no deaths attributable to the antisyphilitic treatment. There were, however, three cases of clinically evident complications directly attributable to the treatment. Two of the patients presented an arsenical hepatitis, while the third developed an arsenical dermatitis. All responded well to treatment. In addition to these there were occasional cases in which the patients experienced temporary gastrointestinal disturbances, syncope, and nitritoid reactions.

It is concluded that the pregnant woman tolerates antisyphilitic treatment well, and the results for both the mother and her unborn child justify its practice.

J. P. GREENHILL.

**Woods, E. B.: Complications of the Treatment of Syphilis in Pregnancy. Report of Three Cases of Arsenical Encephalitis Complicating Such Treatment, J. Med. A. Georgia 25: 23, 1936.**

Woods calls attention to the possible complications in the treatment of syphilis in pregnancy. Emphasis is placed upon the possible confusion of eclampsia and arsenical encephalitis. Careful watching and daily contact with these patients is necessary in order that prodromal symptoms and minor complications which indicate sensitivity may be recognized, for the early recognition of these with cessation of antisyphilitic treatment is the only effective therapy in such complications. Even though there is some danger of reaction from the medicaments used, the overwhelming benefit derived in the majority of pregnant women, together with the responsibility to the unborn child, leaves to the conscientious medical practitioner no choice.

J. P. GREENHILL.

**Cormia, Frank E.: Hemorrhagic Encephalitis From Neoarsphenamine in Pregnancy, Canad. M. A. J. 35: 610, 1936.**

The author reports a fatal hemorrhagic encephalitis occurring in a pregnant patient from neoarsphenamine and then reviews the 135 reported cases. There are 34 known pregnant patients for the review. In general the reaction comes on within five to seven days after 2 or 3 injections of 0.45 gm. of neoarsphenamine (or equivalent). It appears that the incidence runs parallel with the time of larger dosages. The use of heavy metals seems to have little influence. The common prodromal symptoms of fever, headache or generalized body pains, dizziness,

restlessness, nausea and vomiting are followed usually by delirium, semistupor, and finally coma. About one-half of this series had convulsions which became generalized.

The blood pressure and urinary findings are not altered much initially. Leucocytosis is frequent.

The brain lesion is a diapedesis of red cells around dilated capillaries and is concentrated in the white substance, yet often scattered in the grey matter. The more frequent sites are the corpus callosum, caudate and lenticular nuclei, pons and medulla.

The recommendations are: not more than 0.3 gm. of neoarsphenamine weekly as overdosage is the greatest danger; pregnant women are more susceptible and thus must be carefully watched while under treatment: careful observation of any of the above symptoms coming on about two days after any of the first few injections; and large doses of adrenalin if the disease develops and spinal drainage if cerebral edema is present.

H. CLOSE HESSELTINE.

**Dick, W.: Is Transmission to Offspring Possible in a Case of Lymphogranuloma Inguinale?** *Med. klin.* 32: 319, 1936.

Women with the late forms of inguinal lymphogranuloma are often sterile but occasionally give birth to mature infants. In the latter case the fate of the offspring is of interest. The author reports two cases. One concerns a woman with a positive Frei reaction and rectal stricture, who became pregnant and gave birth to a normally developed infant, who had a positive reaction when subjected to a Frei test two weeks after birth. Moreover, at five months the test was again positive. The second case cited by the author concerns a girl, aged fourteen, the daughter of a woman who had died following an attempt to dilate a rectal stricture, the latter being doubtless the result of an inguinal lymphogranuloma. The daughter had complained of rectal disturbances for a number of years; Frei's test was positive, indicating that her rectal disturbances were due to inguinal lymphogranuloma. In this case three modes of transmission were possible: intrauterine infection, infection during the process of birth, and infection after birth by contact with the mother. The author points out that intrauterine transmission seems likely in view of the fact that in adults the Frei test does not become positive until several weeks after the infection and that the nursing baby had a positive Frei test two weeks after birth.

J. P. GREENHILL.

**Roxas, Katigbak, and Leyva: Neurologic Disturbances in Pregnancy and Their Relation to the Calcium and Phosphorus Balance in the Blood, Philippine Island** *M. A.* 16: 535, 1936.

Seventy-eight cases were studied clinically with serum analysis for calcium and phosphorus. Hypocalcemia was found associated with neurologic disturbances in 86.2 per cent of the cases. The blood range in beriberi was also determined in 6 pregnant and 17 nonpregnant women and this may serve as a differential point.

The author contends the cases are insufficient in number to merit anything but a tentative conclusion. He tried to show a relationship between the neurologic disturbances and the calcium concentration in the blood. The condition is frequently met with in the dispensary class. The relation of beriberi merits further study in view of its disastrous effect on the mother.

C. O. MALAND.

**Stähler, Fritz:** B<sub>1</sub>-Hypovitaminosis in Pregnancy, München. med. Wehnschr. 84: 327, 1937.

Stähler reviews 15 patients of polyneuritis in pregnancy in whom he used vitamin B<sub>1</sub> (Betaxin) with marked success, giving 4 to 5 injections of 2 c.c. each every two to four days. He adds that it is also important to use a cod liver oil preparation with the vitamin B<sub>1</sub> treatment as the results appear to be quicker and more lasting.

C. E. PROSHEK.

**Theobald, G. W.:** Neuritis in Pregnancy Successfully Treated With Vitamin B<sub>1</sub>, Lancet 1: 834, 1936.

Five pregnant patients with symptoms or evidence of neuritis were successfully treated with vitamin B<sub>1</sub> concentrate. Brief report is made of each case. Although not all of the findings in patients dying from vitamin B<sub>1</sub> deficiency can be explained directly by its absence, these changes may result from general disturbance in metabolism produced by this single deficiency.

The author feels that there is partial evidence supporting his dietetic deficiency hypothesis of the toxemias of pregnancy. He suggests the name "atelositetic neuritis of pregnancy."

Four of these five patients had all symptoms relieved by this diet.

H. CLOSE HESSELTINE.

**Ferrigno, P.:** A Case of Purulent Meningitis During Pregnancy, Clinica ostet. 15: 650, 1936.

The author presents a case of purulent meningitis caused by the meningococcus of Weichselbaum. Although the patient was a full term pregnant woman suffering with a chronic purulent otitis media, she recovered without surgical intervention upon the ear.

AUGUST F. DARO.

**Harris, J. S.:** Mental Disorder Associated With Child-Bearing, Brit. M. J. 1: 835, 1936.

Though it has long been recognized that no special form of mental disorder is associated with childbearing, various forms of mental disorder are encountered.

The author presents a discussion of three main groups as seen in 45 cases of mental disease associated with pregnancy. The manic depressive group consisted of two cases, a primipara and a multipara. Recovery ensued in from three to four months. The onset in both was postpartum and sudden. A delirious (acute confusional) group comprised 8 patients, of whom 6 recovered. A toxic focus was definite in one case. This group shows two types, a toxic and nontoxic. The onset may be sudden or gradual in the postpartum period. The schizophrenic group comprised 14 patients of whom 7 recovered. Time of onset of the derangement in 5 cases was during pregnancy, from the fourth to the eighth month. In a few the condition followed abortion, and in the remainder it occurred in the postpartum period, anywhere from one week to eight months after delivery. Periods of disability and recovery are discussed.

The mode of onset was definitely sudden in 15 cases, of whom 12 recovered, and gradual in 20 of whom 15 recovered.

The average duration of the psychosis was ten months in the 26 recoveries. The depressive types took a longer time to recover.



The greatest number of mental derangements occurred in primiparas. In these the chances of recovery are more favorable than when present in the second or third pregnancy. In addition to the childbearing as a cause of the breakdown, a number of other factors were found present which appeared to play a part in the development of the psychosis.

F. L. ADAIR AND S. A. PEARL.

**Wong, Amos:** *A Case of Insomnia in Pregnancy*, Chinese M. J. 49: 1146, 1935.

Insomnia in pregnancy is a very common condition. When it reduces a woman's sleep to one to two hours every night for a period of six to seven months, it becomes a rarity.

The common causes of insomnia, such as faulty habits of hygiene, acute and chronic disorders, were not present in this particular case. As to the cause of her insomnia, it was the author's impression that it was of psychic origin. The patient was not suffering physically from insomnia as indicated by the steady gain in weight and the satisfactory growth of the fetus. She came through the pregnancy and labor in good condition.

C. O. MALAND.

**Raimann, E.:** *Therapeutic Interruption of Pregnancy in Nervous and Mental Diseases*, Wien. klin. Wchnschr. 50: 166, 1937.

Because of the legal difficulties involved, and because there is no single disease for which interruption of pregnancy may be recommended without reserve, the disease and the patient as well as the social status and economic circumstances must all be taken into account. Of the diseases considered, viz.: Basedow's disease, status epilepticus, tabes, multiple sclerosis, and the psychoses schizophrenia, melancholia, and such a neurologic lesion as inoperable brain tumor, other factors such as duration of pregnancy and the ultimate effect on mother and child must also be considered. The psychiatrist and the gynecologist must work together. In many cases under combined management the patient may carry her pregnancy to term with appropriate mental treatment. All cases are treated on their relative merits and the dangers in each case should be carefully evaluated.

W. B. SERBIN.

**Silva, Camillo:** *Acute Appendicitis Complicating Pregnancy and the Puerperium*, Ann. di ostet. e. ginec. 15: 1475, 1936.

The author reports 27 cases of acute appendicitis during pregnancy and the puerperium and emphasizes the high mortality and difficulty of differential diagnosis. He states that pregnancy was interrupted in 36 per cent of the cases and the fetal mortality was 24 per cent.

The author claims that the therapy in acute appendicitis during pregnancy is exclusively surgical and occasionally cesarean section is necessary.

A. DARO.

**Norton, James F., and Connell, John N.:** *Appendicitis Complicating Pregnancy and Labor*, Am. J. Surg. 32: 325, 1936.

Acute appendicitis with peritonitis complicating labor, should be managed surgically as it is at any other time, and the labor allowed to continue with delivery through the birth canal, in the absence of an indication requiring a different obstetric procedure.

J. THORNWELL WITHERSPOON.

**Reeb and Irrmann-Wehrung:** Appendicitis and Pregnancy, *Bull. Soc. d'obst. et de gynéc.* 25: 332, 1936.

Among 17,265 confinement cases, appendicitis occurred 22 times, an incidence of 1.27 per cent. According to the authors pregnancy does not predispose to appendicitis but it does favor recurrence of attacks, especially during the first few months. Acute appendicitis results in a certain percentage of abortions, deaths of infants and premature labors. Because pregnancy has a tendency to produce recurrences of appendicitis the authors advise the prophylactic removal of the appendix before marriage in all young women who have had a definite attack. If operation is necessary before the fifth month of pregnancy, a McBurney incision may be made. During the last four months a median incision is preferable. If the appendix can easily be removed, the pregnancy should not be disturbed but antispasmodics given after operation. If, however, the appendix is inaccessible, if there are adhesions, perforation, or gangrene with a localized peritoneal reaction, a cesarean section should first be performed and then the appendectomy. If drainage is necessary an extra incision should be made for this. If there is generalized peritonitis it is preferable to perform a subtotal hysterectomy after a cesarean section and then remove the appendix. Vaginal drainage should then be instituted. In all cases of peritonitis antigangrenous and anticolitis serotherapy should be administered both in the abdominal cavity and by intramuscular injections after operation.

J. P. GREENHILL.

**Burnett, E. C., and McMenemey, W. H.:** Rupture of the Normal Spleen in Pregnancy, *Brit. M. J.* 1: 1122, 1935.

Rupture of the spleen is a rare complication of pregnancy. There were only 15 cases reported in the literature up to 1930. In some the spleen is abnormal and direct trauma is a major factor.

In the present case the organ was normal and the trauma slight. The patient, aged forty-three, gravida xvi, was in the thirty-eighth week of pregnancy. She was healthy and had had no complications with previous labors. All 15 children were alive and well. She leaned back in bed to switch out the light above and behind her. On reaching out with her left hand, she was seized with a pain under the left costal margin and was unable to resume her original position for some time. The pain persisted all night. She vomited once. At 6 A.M. her temperature was 99°, pulse 80. There was pain and tenderness in left costal margin. Pulse rose gradually to 132, and she grew weak. The pain persisted vaguely in both flanks. Her abdomen was tense, heart and lungs negative. The fundus was at the xiphisternum and the uterine wall was felt contracting regularly. She was not in labor.

The fetus was in O.L.A., head not yet engaged. The fetal heart was not heard, and the patient said she had felt no movements since onset of pain. There was diffuse tenderness in both flanks and dullness in left flank, but no pain in left shoulder. The external os was closed. Immediate laparotomy revealed free blood in the abdominal cavity coming from a ruptured spleen. Splenectomy was done after cesarean section due to advanced stage of pregnancy. Except for congestion no pathologic feature was present in the spleen.

F. L. ADAIR AND S. A. PEARL.

**Farncombe, R.:** Foreign Body in the Bladder Associated With Pregnancy, *Lancet* 2: 825, 1935.

The patient had attempted to induce an abortion by using slippery elm in the third month of pregnancy. It was inserted and she thought absorbed. Because of urinary incontinence and dysuria an examination was made at the seventh month when a mass was found in the base of the bladder.

The patient delivered at the eighth month without difficulty. On the seventh postpartum day an abdominal cystotomy was performed when the foreign body, the slippery elm, was removed from the urethra and bladder. The patient had a satisfactory convalescence but a subsequent intravenous pyelogram showed marked pyelectasis of both kidneys and a small bladder having a grossly irregular outline.

H. CLOSE HESSELTINE.

**Turner, G. Grey:** *Labour Complicated by Thrombosis of the Mesentery*, *Lancet* 1: 802, 1937.

Ordinarily abdominal emergency operations are rare during pregnancy and are usually limited to those for the treatment of appendicitis, gallstones and torsion of pedunculated tumor. The author reports a case of resection of a portion of the small intestine done for a mesenteric thrombosis. The patient had previously had a perforating gastric ulcer repaired. A few years later during labor the patient presented evidence of intraabdominal hemorrhage. The uterus was emptied by cesarean section, after which the injured bowel was resected. Convalescence was stormy for several days. The patient had a miscarriage about one year later but no other pregnancies. No other complications developed during the next twenty-four years.

H. CLOSE HESSELTINE.

**Yule, E.:** *Spontaneous Rupture of a Pregnant Uterus and Subsequent Atrophy of Fibroids*, *Brit. M. J.* 1: 582, 1936.

The author had the rare opportunity to observe the presence of multiple fibromyomas during laparotomy for rupture of a pregnant uterus, and to confirm their subsequent atrophy at an operation for appendectomy a year later. Clinical notes on the case and the findings at operation are given. The treatment was cesarean section and repair of the rent in the uterus. The atrophy of the fibroids apparently occurred in the absence of any appreciable symptoms of an approaching menopause.

F. L. ADAIR AND S. A. PEARL.

**Didier, Robert:** *The Enucleation of Large Fibroid Tumors During Pregnancy*, *Gynéc. et obst.* 34: 363, 1936.

Altho many uterine fibroids permit the uninterrupted progression of pregnancy, certain of these tumors by virtue of their size or location will necessarily interfere with pregnancy at some stage.

Five cases are reported in which large uterine fibroids complicating gestation were removed by enucleation with no detrimental effect upon the pregnancy and with subsequent delivery of living babies. Four were at term, one at seven months. The smallest tumor weighed 600 gm., and the heaviest 3000 gm.

The author advises operation between the third and fifth month when the uterine wall is thick and enucleation is easily performed. Earlier, there is risk of abortion; later, the operation is more difficult. The uterine cavity must not be opened.

ARNOLD GOLDBERGER.

**Siegmund, H.:** *Myoma Operations During Pregnancy With the Aid of Corpus Luteum Hormone Therapy*, *Wien. klin. Wchnschr.* 49: 1193, 1936.

Myomas may easily but not always disturb the course of pregnancy. The effect is determined by the type of fibroid and its location in the uterus. Depending upon

the location of the fibroid and its effect on the pregnancy, the latter may either be conservatively carried to term with little or no treatment or operative treatment may become necessary. This may consist of a myomectomy preserving the pregnancy while in some cases the entire uterus must be removed. The author reports two cases treated by conservative myomectomies and then pregnancies being fortified with corpus luteum hormone. Both patients were at term delivered of living healthy babies.

W. B. SERBIN.

**DaLéas, P.: Malaria and Pregnancy, Rev. franç. de gynéc. et d'obst. 31: 232, 1936.**

The author has had an extensive experience in Indo-China treating pregnant women who had malaria. His experience is based upon 8,000 deliveries. He found that malaria affects pregnancy just as any other acute and chronic infectious disease. Because malaria affects the liver and kidneys, complications of these organs frequently arise. On the other hand, pregnancy occurring in a woman once infected with malaria may suddenly produce a lighting up of the old infection. Frequently the child is infected in utero. This often results in interruption of pregnancy. The children who are born only slightly infected have a good prognosis.

J. P. GREENHILL.

**Ghose, Sudhansu Kumar: Malaria as a Complication in Pregnancy, Calcutta M. J. 30: 541, 1936.**

The author reports a case of malaria complicating an eight-month pregnancy and terminating in the death of mother and fetus. The clinical course closely simulated acute yellow atrophy of the liver. The salient points to be learned from this fatality are as follows: (1) that the presence of intense vomiting and jaundice led to a diagnosis of toxemia rather than malaria; (2) the importance of blood examination in fever cases. This life could have been saved by an earlier detection of the malaria parasite in the blood and antimalarial therapy. (3) In spite of a heavy infection of the maternal blood, no malaria parasites could be found in the cord blood or in the heart of the dead fetus.

F. L. ADAIR AND S. A. PEARL.

**Morra, Giuseppe: Nicotine Intoxication and Pregnancy, Ginecologia (Torino) 9: 996, 1935.**

After reviewing the literature, the author discusses the pharmacology and toxicology of nicotine.

From his personal research on the chronic experimental nicotine intoxication during gestation he forms the following conclusions: (1) Nicotine experimentally introduced into the maternal organism can pass through the placental barrier, and can be detected in the fetal tissue by biologic methods. (2) The course of pregnancy is influenced relatively little in the rabbits subjected to chronic nicotine poisoning. Moreover, prematurity of birth was observed in the poisoned animals.

AUGUST F. DARO.

## Items

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### **American Association of Obstetricians, Gynecologists and Abdominal Surgeons**

Rules governing the award of "The Foundation Prize" of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons.

1. "The award which shall be known as 'The Foundation Prize' shall consist of \$500.00.

2. "Eligible contestants shall include only (a) internes, residents, or graduate students in Obstetrics, Gynecology or Abdominal Surgery, and (b) physicians (with an M.D. degree) who are actively practicing or teaching Obstetrics, Gynecology or Abdominal Surgery.

3. "Manuscripts must be presented under a nom-de-plume, which shall in no way indicate the author's identity, to the Secretary of the Association together with a sealed envelope bearing the nom-de-plume and containing a card showing the name and address of the contestant.

4. "Manuscripts must be limited to 5,000 words, and must be typewritten in double-spacing on one side of the sheet. Ample margins should be provided. Illustrations should be limited to such as are required for a clear exposition of the thesis.

5. "The successful thesis shall become the property of the Association, but this provision shall in no way interfere with publication of the communication in the Journal of the Author's choice. Unsuccessful contributions will be returned promptly to their authors.

6. "All manuscripts entered in a given year must be in the hands of the Secretary before June 1.

7. "The award will be made at the Annual Meeting of the Association, at which time the successful contestant must appear in person to present his contribution as a part of the regular scientific program, in conformity with the rules of the Association. The successful contestant must meet all expenses incident to this presentation.

8. "The President of the Association shall annually appoint a Committee on Award, which, under its own regulations shall determine the successful contestant and shall inform the Secretary of his name and address at least two weeks before the annual meeting."

JAS. R. BLOSS, M.D., *Secretary*.  
418 Eleventh Street,  
Huntington, W. Va.



### **American Board of Obstetrics and Gynecology**

The general oral, clinical and pathological examinations for all candidates (Groups A and B) will be conducted by the entire Board, meeting in San Francisco, California, on June 13 and 14, 1938, immediately prior to the meeting of the American Medical Association.

Application for admission to the June, 1938, Group A examinations must be on an official application form and filed in the Secretary's Office before April 1, 1938.

The annual informal Dinner and General Meeting of the Board will be held at the Palace Hotel, San Francisco, on Wednesday evening, June 15, 1938, at seven o'clock. Dr. William D. Cutter, Secretary of the Council on Medical Education and Hospitals of the American Medical Association, will be the guest speaker, and the Diplomates certified at the preceding days' examinations will be introduced individually. All Diplomates are invited to attend the dinner meeting, and to bring as guests their wives and any persons interested in the work of the Board.

For further information and application blanks, address Dr. Paul Titus, Secretary, 1015 Highland Building, Pittsburgh (6), Pennsylvania.

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### **International Congress for Obstetrics and Gynecology**

The International Congress for Obstetrics and Gynecology will convene at Amsterdam, Holland, from May 4 to 8, 1938. The program of the proceedings was published in the January issue of this JOURNAL. For further information about travel arrangements, hotel reservations, etc., apply to Messrs. Thos. Cook & Son, 587 Fifth Avenue, New York City.

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### **Erratum**

In a paper entitled "A Combined Operation for Complete Hysterectomy," by S. H. Geist, published in the June, 1937, issue of this JOURNAL (p. 1081), I inadvertently omitted a reference to the effect that a similar procedure was described in Döderlein and Kroenig's *Operative Gynecology* (Fifth Edition, Thieme, Leipzig, 1924, p. 554). A combined operation was referred to in which, after liberating the cervix, the uterus was removed from above. The method was discontinued, however, with the advent of the Trendelenburg posture.

S. H. GEIST.

## Books Received

**APPROVED LABORATORY TECHNIC.** By John A. Kolmer, Professor of Medicine, Temple University, etc., and Fred Boerner, Assistant Professor of Bacteriology, School of Medicine and Graduate School of Medicine, University of Pennsylvania, etc. Second edition. Rewritten, revised and reset, with 12 plates and 380 illustrations in the text, 893 pages. D. Appleton-Century Co., New York, 1938.

**FEVER THERAPY.** Abstracts and discussions of papers presented at the First International Conference on Fever Therapy, March 29-31, 1937. College of Physicians and Surgeons, Columbia University, New York. 486 pages. Paul B. Hoeber, Inc., New York, 1938.

**MILESTONES IN MEDICINE.** Laity lectures of the New York Academy of Medicine. Introduction by James Alexander Miller, M.D. 276 pages. D. Appleton-Century Co., New York, 1938.

**DIE VITAMINE IN DER CHIRURGIE.** Von Professor Dr. Erich Schneider, Chirurgische Univ. Klinik, Freiburg i.B. Verlag von Ferdinand Enke, Stuttgart, 1938.

**EIGHTH INTERNATIONAL CONGRESS OF MILITARY MEDICINE.** Brussels, 1935. Report of Captain William Seaman Bainbridge. U. S. Gov. Printing Press, Washington, 1937.

**DISEASES OF WOMEN,** for the General Practitioner. By Paul Titus, M.D., Obstetrician and Gynecologist to the St. Margaret Memorial Hospital, Pittsburgh, etc. Edited by Morris Fishbein, M.D. Illustrated, 320 pages. National Medical Book Co., Inc., New York, 1937.

**OPERATIVE GYNECOLOGY.** By Harry Sturgeon Crossen, Professor Emeritus of Clinical Gynecology and Obstetrics, and Robert James Crossen, Assistant Professor of Clinical Gynecology and Obstetrics, Washington University School of Medicine, etc. Fifth edition, entirely revised and reset. With 1,264 illustrations including three color plates on 1,076 pages. The C. V. Mosby Company, St. Louis, 1938.

**A HISTORY OF WOMEN IN MEDICINE.** From the earliest times to the beginning of the nineteenth century. By Kate Campbell Hurd-Mead, M.D. Illustrated, 569 pages. The Haddam Press, Haddam, Conn., 1938.

**THE PHYSICIAN'S BUSINESS.** Practical and Economic Aspects of Medicine. By George D. Wolf, M.D., Attending Oto-Laryngologist, Sydenham Hospital, New York City, etc. Foreword by Harold Rypins, M.D., F.A.C.P. With 57 illustrations, 384 pages. J. B. Lippincott Company, New York, 1938.